



**NCDA & CS  
Plant Industry Division  
Annual Report  
2013**



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## NORTH CAROLINA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES



### *Mission Statement*

The mission of the North Carolina Department of Agriculture and Consumer Services is to provide services that promote and improve agriculture, agribusiness, and forests; protect consumers and businesses; and conserve farmland and natural resources for the prosperity of all North Carolinians.

**Steve Troxler**  
**Commissioner of Agriculture**  
**Chairman, Board of Agriculture**

### North Carolina Board of Agriculture



**Maurice Berry**  
**General Farming**

**William Johnston**  
**General Farming**

**Kirk Mathis**  
**Poultry**

**Bert Pitt**  
**General Farming**

**Mark Peters**  
**Marketing-Green Industry**

**Jeffrey Turner**  
**Pork**

**Casey Armstrong**  
**General Farming-Equine**

**Doug Boyd**  
**Cotton**  
**(photo coming)**

**Tommy Burleson**  
**Forestry**  
**(photo coming)**

**John W. “Billy” Carter**  
**Tobacco**  
**(photo coming)**

**Bob Sutter**  
**Peanuts**  
**(photo coming)**

## CONTACT INFORMATION

### Commissioner and Executive Staff

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Joe Reardon	Assistant Commissioner	(919) 707-3009
Dr. Richard Reich	Assistant Commissioner	(919) 707-3015
Scott Bisette	Assistant Commissioner	(919) 857-4844

### Director and Administrative Staff

Vernon N. Cox	Division Director	(919) 707-3732
Phil Wilson	Plant Protection Section Administrator	(919) 707-3753
Danny Turner	Seed and Fertilizer Section Administrator	(919) 707-3735
Cheri Toner	Administrative Officer II	(919) 707-3731

### Plant Industry Division

Plant Industry Division Web Site: <http://www.ncagr.gov/plantindustry/>

#### Facilities:

#### Plant Industry Division-Administrative Offices and N.C. Seed Laboratory

**Physical Address:** 216 West Jones Street, Raleigh, NC 27603

**Mailing Address:** 1060 Mail Service Center, Raleigh, NC 27699-1060

#### Support Operations

**Physical Address:** 1013 Blair Drive, Raleigh, NC 27603

**Mailing Address:** 1060 Mail Service Center, Raleigh, NC 27699-1060

#### Biological Control Services

**Physical Address:** 950 East Chatham Street, Cary, NC 27511

**Mailing Address:** 1060 Mail Service Center, Raleigh NC 27699-1060

#### Witchweed Program Facilities

**Physical Address:** 450 Smith Circle, Room 108, Elizabethtown, NC 28337

**Mailing Address:** Same as above

**Physical Address:** Agri-Expo Center, 301 Mountain Drive, Room 204, Fayetteville, NC 28306

**Mailing Address:** Same as above

**Physical Address:** O.P. Owens Agric. Center, 405 Country Club Drive, Lumberton, NC 28358

**Mailing Address:** Same as above

## **ACCOMPLISHMENTS: ADMINISTRATIVE AND SUPPORT SERVICES SECTION**

The NCDA&CS, Plant Industry Division state authorized budget for 2012-13 was \$5,518,293 and included total permanent staff of 90. For this fiscal year, there were significant increases in the phytosanitary fees collected by field staff. The Plant Industry Division continued its work with other organizations with the administration of cooperative agreements. For the period, over \$2 million in cooperative agreement funding was received and administered for work with joint plant pest regulatory programs.

There were several significant changes in Division leadership during 2013. Gene Cross retired as Division Director in October, 2012 and Vernon Cox, after serving in an interim capacity, was appointed Division Director in May, 2013. Roger Cross, a 25-year employee in the NC Seed Laboratory, was appointed as Seed Laboratory Supervisor in February and David Welch was hired at that same time as the new Plant Conservation Program Administrator. In June, Jarred Driscoll was hired as the coordinator for the Cooperative Agricultural Pest Survey and Leah Roberts was hired in September as the Division Plant Pathologist. In addition, several critical field, laboratory and administrative positions were filled with very capable new employees. With these changes, the Plant Industry Division is well positioned to successfully face the challenges that will arise in 2014.

The Plant Industry Division, Support Operations Unit provides critical support for all the Division's programs, including the maintenance of Division vehicles, equipment, and staff as needed to meet the needs of the service and regulatory programs. This unit also assists the Division with the implementation of safety/seasonal employee orientation.

## **ACCOMPLISHMENTS: PLANT PROTECTION SECTION**

The mission of the Plant Protection Section is to enhance the quality of life in North Carolina by protecting agriculture and the environment from injurious plant pests, by promoting beneficial organisms, and by protecting rare native plants of the state.

We serve the people of North Carolina by:

- Protecting agricultural crops, horticultural crops and native flora, by preventing or controlling the invasion and spread of injurious insects, plant pathogens, weeds, and other pests of regulatory concern.
- Protecting honey bees by combating the spread of bee pathogens.
- Responding to constantly changing threats to crops, rare native plants, and honey bees by drafting effective and reasonable regulations and by achieving public compliance.
- Supporting agriculture, horticulture and related industries by providing inspection and export services to facilitate the movement of regulated commodities.
- Protecting rare native plants by restoring their habitats, and by propagating and restoring them to the wild.
- Promoting beneficial organisms that serve as biological controls of pest species.
- Providing outstanding service and satisfaction to all our clients.

North Carolina has an extremely wide range of climate, from near tropical along the southeast coast to winter conditions similar to southern Canada in our higher mountains in the west. Such diversity provides suitable environments for an extremely diverse flora and fauna. Extensive international air and sea transportation, both military and commercial, and an extensive Interstate Highway System increase the potential for the accidental introduction of pest organisms into North Carolina. Therefore, North Carolina's Plant Protection Section programs must deal with a wide range of organisms and host-pest interactions.

Major program activities for the period January 1 through December 31, 2013 are described in the following reports.

## **Apiary Inspection Program**

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The North Carolina beekeeping industry remains viable and is expanding, particularly with new hobby beekeepers. Our inspectors help beekeepers through field inspections, educational meetings, and field days and attempt to be available to assist the beekeepers in any way necessary. In 2013, our Apiary inspectors conducted 9,364 inspections of beekeeping facilities. Our goal is to continue to improve our overall inspections and in particular our documentation of them. Our ultimate objective is to reduce the rate of honey bee disease and pest problems. The proportion of colonies



found with American Foul Brood (AFB) to the total number of colonies inspected appears to be less than 1%, which demonstrates progress in controlling AFB. It is our belief that the ethylene oxide fumigation chamber operated by our program has been a valuable tool in controlling AFB as well as in controlling other serious pests and diseases. We continue to have a Special Local Need (24C) registration for this fumigant and expect to continue to provide this service to our beekeepers.

The *Varroa* mite persists as a major threat to the beekeeping industry in North Carolina and is probably a contributing factor to many of the circumstances already described. Several new products have been registered for use in controlling this pest; however, the mites have developed resistance to some of these materials in short order and rendered these products ineffective. The most recently registered miticide, Apivar®, was registered in July of this year (2013). It would be premature for us to assess the efficacy of this material. Although chemical treatment of mites may be necessary, some miticides have been demonstrated to have adverse effects on bees. Another aggravating factor is the growing use of unregistered materials that may also have adverse effects on honey bee health and may not be efficacious in controlling mites. This and, in some cases, the improper use of antibiotics to control diseases can further complicate useful treatment regimes.

Beekeepers are expressing concerns about pesticides, particularly the neonicotinoids. The Structural Pest and Pesticides Division has responded to acute bee kill losses and followed up according to the evidence. With regard to sublethal effects, apiary personnel collected pollen samples from colonies suspected to be exposed to neonicotinoids. The samples contained no detectable levels of those chemicals.

Colony Collapse Disorder (CCD) remains a major topic of discussion among beekeepers. The press coverage has highlighted the value of honey bees to a broader audience and raised awareness of their importance. Our inspectors have seen colonies that share many of the symptoms attributed to CCD. Due to the restricted parameters described as symptoms of CCD, this disorder cannot yet be documented in North Carolina. This is not to say that it has not occurred here, but we have not seen evidence specifically attributable to this condition. Most of the colonies we have inspected that show symptoms correlating to CCD reveal evidence of high mite loads or other familiar disorders.

Another threat facing the beekeeping industry in North Carolina is the establishment of Africanized Honey Bees (AHB) (*Apis mellifera scutellata*) in southern Florida (and finds in Georgia). There has also been a widely distributed report from Tennessee regarding AHB. We believe these reports were based upon a misinterpretation of the AHB identification system. In North Carolina we are engaged in an outreach program to emergency response personnel to familiarize them to the potential threat of AHB. We are also reaching out to the structural pest industry and its membership. We are actively collecting samples of bees (particularly those from colonies with overly defensive behavior) in order to determine their geographic origin and their propensity for this behavior. NCDA&CS and NCSU are collaborating in conducting this survey. At this time, none of the samples collected have been determined to be of the AHB type. We are striving to have our inspectors and our lab prepared to deal with any AHB incursion or incident. **We encourage beekeepers to please let us know of any colonies that seem to be displaying any unusual or inexplicable defensive behavior. We want to maintain a beekeeping industry in North Carolina that is not threatened by the reputation of this more defensive type of bee.**

We continue to enjoy a good working relationship with our friends in the NC State University Apiculture Research and Extension Program. We have had the opportunity to assist them in some of their projects and would like to express our gratitude for their assistance in many of our projects.



## **Biological Control Programs**

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*CERCERIS FUMIPENNIS* AND  
PREY



HEMLOCK WOOLLY ADELGID



IMPORTED FIRE ANT AND  
PHORID FLY



KUDZU BUGS



MILE-A-MINUTE VINE WEEVIL

The mission of the biological control program is to manage exotic pests using ecologically-based methods. We focus on “classical” biocontrol that is, reuniting exotic pests with the natural enemies that keep them below damaging levels in their home ranges. Although we are primarily an implementation program, conducting these projects requires research to ascertain the appropriateness of releasing biological control agents or to follow up on agents released. The biological control program of the NCDA&CS was founded in the 1970s to investigate and establish natural controls for the gypsy moth, a visionary undertaking in advance of the invasion of that pest. Today, our projects focus on a variety of exotic pests, and involve laboratory rearing of insects, field releases of natural enemies, surveying, and the operation of a United States Department of Agriculture inspected containment (quarantine) facility.

Rooms in the containment facility are available to industry and university researchers for short-term use. Such cooperation allows projects to be completed in a secure environment, and provides the opportunity to work on potential pests before they are established in North Carolina. Seven shipments of exotic material were received by the NCDA&CS Insect Quarantine Facility during 2013.

**Table 1** Summary of Biological Control Program Quarantine Activities 2013

ID #	SPECIES	FAMILY	STAGE	#	ORIGIN	STATUS
Q11-9	<i>Sirex noctilio</i> <sup>1</sup>	Siricidae	Adults/ Eggs/larvae	64 logs	NY	Logs maintained in quarantine awaiting wasp emergence.
Q12-8	<i>Imperata Cylindrica</i> <sup>2</sup>	Poaceae	Seeds	2 seed heads	NC	Determine if seeds are viable.

<sup>1</sup>Dr. Coby Schal, NCSU Entomology Dept., NCSU will utilize *Sirex* to hopefully develop semiochemical tools to facilitate early detection, population monitoring and ultimate control of *Sirex noctilio*.

<sup>2</sup>Seed heads from the Federal Noxious Weed *Imperata cylindrica* were examined to determine if any seeds present were viable.

As a regulatory function, the Biological Control Administrator reviewed 11 applications for USDA-APHIS-PPQ Permit 526 for release of beneficial organisms during 2013.

### **Implementation of *Cerceris fumipennis* as a Biosurveillance Tool for Pest Buprestidae in North Carolina - 2013**

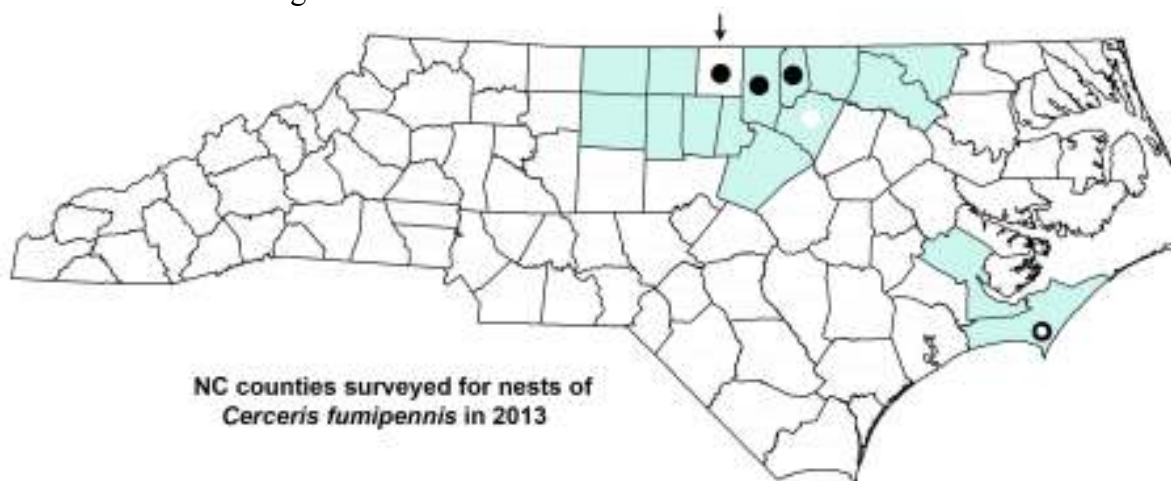
Christine A. Nalepa and Whitney G. Swink

The solitary ground nesting wasp *Cerceris fumipennis* is being utilized as a biosurveillance tool for the efficient collection of pest buprestid beetles in Canada and in several locations in the eastern United States. In 2013 we continued our studies of the wasp in North Carolina (NC), with the following **goals**:

- 1) Continue to locate sites with high nesting activity, particularly in areas at high risk of having Emerald Ash Borer (EAB; *Agrilus planipennis*).
- 2) Collect and identify buprestid prey of *C. fumipennis*.
- 3) Initiate studies of foraging behavior in *C. fumipennis*.

#### ***1) SURVEYS FOR NESTS OF CERCERIS FUMIPENNIS***

We continued our survey of ball diamonds for nesting sites of *C. fumipennis* in NC during 2013, concentrating our efforts in counties where EAB is either established or an eminent threat: the north central border with Virginia and the central coast.



**Figure 1** Counties surveyed for nests of *Cerceris fumipennis* in 2013.

We concentrated on areas where EAB is known (black dots) or suspected (black-outlined dot). Person Co. (arrow) was surveyed during 2012. One site appropriate for biosurveillance was found (Franklin Co., white dot).

A total of 291 ball fields in 15 counties were visited during the 2013 survey (Figure 1; Table 2); we found *C. fumipennis* nests in 33 of these (11.3%). Follow-up biosurveillance was justified in just one positive site (Franklin Co.); the remaining positive ball fields all had fewer than 15 nests. On a per site basis (a single site may have more than one ball field), 18.2% (28 of 154) of the sites were positive, with the single site in Franklin Co. having sufficient number of nests to justify biosurveillance (0.6% of sites surveyed). Three marginal sites surveyed in 2012 (9 to 16 nests present) were resurveyed during 2013; two were negative, and one had 12 nests.

**Table 2** Results of 2013 survey of ball fields for nests of *Cerceris fumipennis*

COUNTY	DATES SURVEYED	NO. FIELDS SURVEYED	NO. POS. FIELDS	NO. SITES SURVEYED	NO. ? <sup>1</sup>	NO. NEG.	NO. POS.	NO. NESTS AT POS. SITES <sup>2</sup>
Alamance	13, 20 Jun	28	2	18	3	14	1	9 (8+1)
Cartaret	4-5 Jun	36	7	14	0	9	5	22 (4+14+4),2,4,1,4
Caswell	12-Jun	5	1	2 (2 resurvey)	0	1	1	12
Craven	4-6 Jun	21	2	6	2	3	1	5 (1+4)
Durham	21, 26 Jun	18	0	11	0	11	0	
Franklin	17-18 Jun	24	7	14	1	7	6	4,4,3,(>100+7) 1,1
Granville	11-13, 19 Jun	20	3	13	0	10	3	1,2,1
Guilford	12 Jun, 17 Jul	50	1	27	4	22	1	2
Halifax	27-Jun	9	1	5	0	4	1	3
Northampton	27-Jun	2	0	1	0	1	0	
Orange	21-Jun	17	2	7	2	3	2	2,3
Rockingham	12-Jun	8	1	7 (1 resurvey)	3	3	1	6
Vance	12-13 Jun	17	3	13	3	7	3	1,1,2
Wake	2 and 16 Jul	29	3	13	2	8	3	6,2,1
Warren	27-Jun	7	0	3	0	3	0	
<b>TOTALS: 15</b>	<b>4 June – 17 July</b>	<b>291</b>	<b>33</b>	<b>154</b>	<b>20</b>	<b>106</b>	<b>28</b>	

<sup>1</sup> Question mark (?) means that we were unable to survey because the ball field was gone, fenced /locked, or in use.

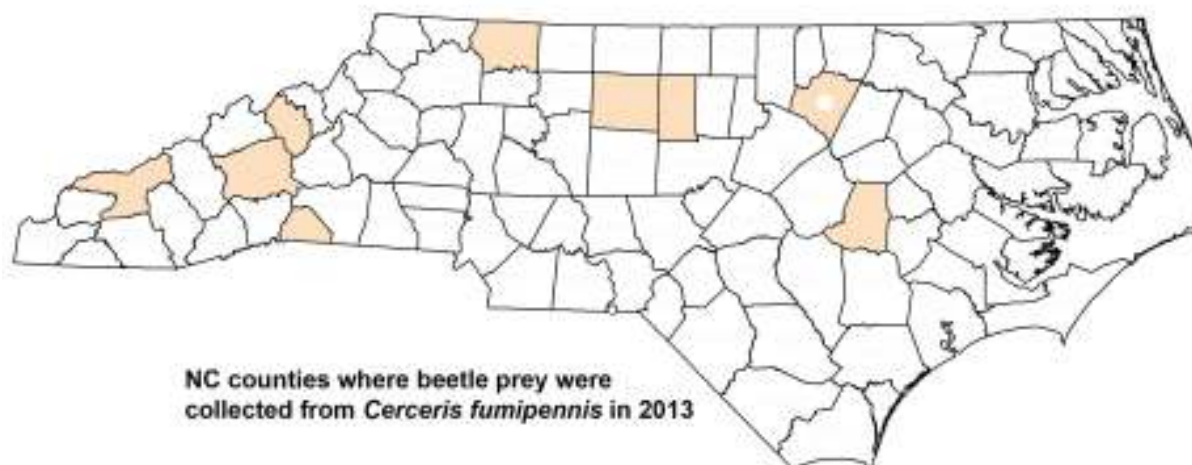
<sup>2</sup> Numbers in parentheses are nest counts from separate ball fields at a single site.

## 2) COLLECTION OF BUPRESTID BEETLES FROM *CERCERIS FUMIPENNIS*

We successfully collected beetles from wasps in nine counties, primarily from nest sites located during surveys prior to 2013: Alamance, Buncombe, Franklin, Guilford, Polk, Surry, Swain, Wayne, and Yancey (Figure 2). Master Gardeners and NCDA specialists were recruited to help conduct biosurveillance, particularly in the mountains and at the coast. To date (2009 to present), we have collected beetles from a total of 23 counties in North Carolina.

A total of 366 beetles were collected from *C. fumipennis* during the 2013 biosurveillance survey. Initial examination of prey indicates that all but one beetle collected by *C. fumipennis* belonged to the Buprestidae—the non-buprestid was *Neochlamisus* sp. (Chrysomelidae), a known alternate prey of the wasp.

No EABs were identified in the collected material. To date, ten genera have been identified from the 2013 collected beetles: *Actenodes*, *Agrilus*, *Brachys*, *Buprestis*, *Chrysobothris*, *Dicerca*, *Eupristocerus*, *Phaenops*, *Ptosima* and *Spectralia*. Included are two native pests, *Agrilus bilineatus* (two-lined chestnut borer) and *Phaenops fulvoguttata* (hemlock borer); both were also collected during surveys of previous years. A species collected in Asheville, *Ptosima gibbicollis*, is not only a new prey record but is also a new genus record for *C. fumipennis*; larvae of *P. gibbicollis* utilize *Cercis canadensis* (eastern redbud) as host.



**Figure 2** Counties in which prey beetles were collected from *Cerceris fumipennis* in 2013.

In all but one (Franklin Co., white dot), these nest/biosurveillance sites were discovered during nest surveys of previous years.

### 3) STUDY OF FORAGING ACTIVITIES IN *CERCERIS FUMIPENNIS*

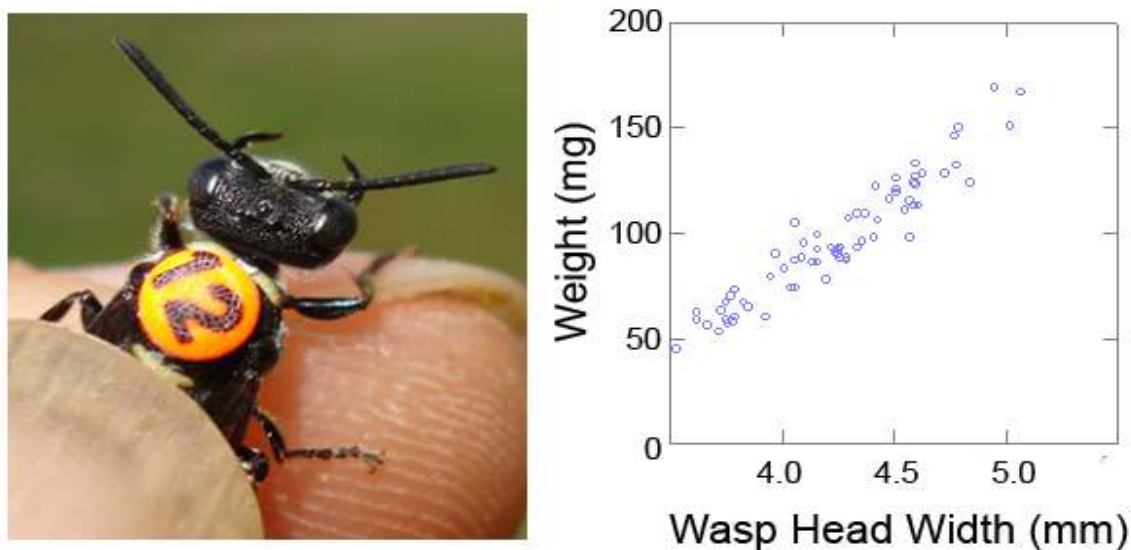
Females of *Cerceris fumipennis* hunt Buprestidae in the canopy, out of reach and out of view. In the summer of 2013 we initiated studies of prey choice in individuals by measuring and marking females, then identifying and weighing the prey items they brought back to the nest.

The study site was a ball diamond at an elementary school in Goldsboro, Wayne Co. (35.398° N, 78.013° W). The field had undergone maintenance on 31 May 2013; the study commenced on 2 June 2013, when 12 nests were noted on the field. One discarded buprestid was collected at that time, indicating that wasp foraging had been initiated.

On five days between 2 June and 15 June, attempts were made to capture all wasps flying on the field. Those that could be netted were weighed, measured, and marked ( $n = 64$ ). Weights were recorded in the field using an Ohaus Scout Pro balance (0.001g). Each female was weighed three times and the average recorded. Wasp head width was taken using a Mitutoyo Absolute Digimatic Caliper (0.01mm); as with the weights, three measurements taken and the average recorded. Females were given a distinctive mark by attaching a small numbered plastic disc to the thorax (Queen Marking Kit; The Bee Works, Orillia, ON, Canada) with a dot of Loctite® Super Glue (Figure 3). The wasp was then gently released near her point of capture. Although unmarked females were still spotted after 15 June, no further wasps were marked or measured until the final day of the study; at that time all females carrying prey were captured and if unmarked, were weighed and measured.

On six days between 12 June and 16 July marked females observed carrying prey were netted, the mark on the thorax recorded, and the wasp released. Her prey beetle was weighed as above, transported to the laboratory on ice, then frozen until pinned, labeled and identified. Marked females without prey were noted, to obtain data on mark retention.

**Results.** The number of wasps active on the field typically exceeded the number of nests. On the first day of the experiment we were able to mark 16 females, with just 12 nests on the field. None of these early marked females were subsequently captured with prey. Overall, a total of 64 wasps were marked over 5 days between 2 and 15 June, but the highest number of nests present on the field was 43.



**Figure 3** *Cerceris fumipennis*

**(Left)** Female of *Cerceris fumipennis* with numbered marker attached; **(Right)** relationship between head width and body mass (wet weight) in *C. fumipennis*.

Wasp wet weight averaged 96.8 mg ( $n = 68$ ) and ranged from 45 to 168 mg. As expected, there was a significant relationship between wasp head width and wasp wet weight (Figure 3).

Mark retention was thought to be good, although the tag of one female was found in a nest tumulus two days after it was attached. Overall, 27 of 64 marked females (42%) were re-sighted during the study, four of them more than a month after marking. The record was 42 days: a female marked on 4 June was spotted on the last day of the study.

A total of 54 buprestids were collected from 24 marked and four unmarked wasps. A single prey item was collected from half of these females ( $n=14$ ). Two prey items were collected from 11 females, three prey items were collected from one, four prey items were collected from one, and between 12-20 June, nine buprestids were collected from one busy huntress.

Prey weight averaged 76% of wasp weight, and ranged from 9 to 149%. Ten different females were recorded as carrying prey larger than they were, ranging from 103 to 149% of their wet weight. The wasps that could carry more than their body weight were at the large end of the size range, averaging 121 mg in weight. Fourteen species were represented among the beetle prey, dominated by the large-bodied *Buprestis maculipennis* ( $n=32$ ) and *B. lineata* ( $n=6$ ). Analysis of the results is ongoing.

#### 4) ADDITIONAL ACTIVITIES

W.G. Swink presented results from the *C. fumipennis* biosurveillance project at the Plant Industry Division Specialists's Meeting 27-28 February 2013, at the Southern Appalachian Forest Entomologist/Pathologist Seminar in Crossnore, NC, 7-8 March 2013, and at the Annual Meeting of the Entomological Society of America meeting in Austin, TX, 10-13 Nov 2013.



During 2013, two papers were published in professional journals:

Swink, W.G, S.M. Paiero and C. A. Nalepa. 2013. Buprestidae collected as prey by the solitary, ground-nesting philanthine wasp *Cerceris fumipennis* (Hymenoptera: Crabronidae) in North Carolina. *Ann. Entomol. Soc. Amer.* 106(1): 111-116.

Nalepa C.A., W. Swink, P. Merten, and J. E. Moan. 2013. Conservative estimates of hunting distance in *Cerceris fumipennis* Say (Hymenoptera: Crabronidae). *J. Entomol. Sci.* 48(4): 299-305.

### **Acknowledgements**

We thank Rebecca Norris for survey of the counties along the Virginia border, and the Master Gardeners and NCDA&CS specialists that served as volunteers: Alan Larkins, Bill Williams, David Pearce, Chris Elder, Ginger Hemmings, and Sue Dial.

### **Hemlock Woolly Adelgid Predator Rearing, 2012 – 2013**

The primary objective for this project was for NCDA&CS to provide biological control agents for the management of hemlock woolly adelgid (HWA). *Sasajiscymnus tsugae* (St), native to Japan has been in mass production at the lab since December 2002. In May and July of 2008, newly collected *S. tsugae* from Japan were received in our quarantine facility to broaden the gene pool in the colony. The Japanese strain and a cross of the old colony and the Japanese were maintained in the lab until the summer of 2012 when the colony crashed.

The hemlock woolly adelgid occurs over multiple states, and is now distributed throughout the native range of the eastern and Carolina hemlock species. Hemlock is widespread in National and State Forests and Parks, and the loss of the hemlock is causing major changes to the ecology of those areas. In addition to a loss of a unique ecosystem, dead and dying trees are a safety hazard in recreation areas, as well as aesthetically unattractive. Although some chemical control measures are recommended for specimen trees, control with insecticides is difficult in any setting and impractical to impossible in forest settings. Because the hemlock stands and HWA infestations are scattered over a wide area, rearing and releasing large numbers of beetles in carefully-selected areas is preferred to relying on natural spread. A large-scale central rearing program supported by the USDA Forest Service can provide these agents and coordinate releases for the southeastern region.

**Methods.** The predator beetles are well synchronized with the life cycle of the adelgid. The adelgid becomes dormant for the summer as early stage settled nymphs, and in response, the beetles also enter a period of reproductive dormancy. During the summer of 2012, beetles in the colony began to die off at alarming rates, and avoided the hemlock twigs presented for food. They continued to feed on honey, but mortality continued. No microsporidia were found in a sample we looked at in the lab, so we sent samples of the honey to the NCDA&CS pesticide lab for testing. Low levels of Coumaphos, a miticide/insecticide, were present, but we do not know that this is what caused the death of the beetles. It is possible that the hemlock was also contaminated, but it was collected from an area where official treatments had not been applied.

At the end of aestivation period, replacement beetles were supplied by Patrick Parkman of the Lindsay Young Beneficial Insect Lab of the University of Tennessee. When the adelgid began to mature and prepare for oviposition, hemlock boughs were stored in spring-like conditions to stimulate oviposition.

For mass production of the colony, mating groups of beetles were placed in 3.8 l jars supplied with a bouquet of hemlock twigs. Eggs (on the twigs) were removed weekly and put in rearing cages supplied with infested hemlock. Infested twigs and water were supplied, and after 4 weeks, adult beetles collected and moved into storage cages. Oviposition jars for the 2012-2013 season were set up beginning November 3, 2012, with numbers of jars increasing as egg-laying increased. Beetles were moved into storage cages and shipped at regular intervals to the USDA Forest Service in western NC and to the Maine Department of Forestry. Oviposition concluded June 5, 2013.

To assess quality control during the production season, a sample of 100 newly eclosed beetles was removed from a single cage each week. Beetles were separated by sex and weighed to the nearest mg. Data were analyzed using the single factor analysis of variance (ANOVA) in Microsoft Excel 2007.

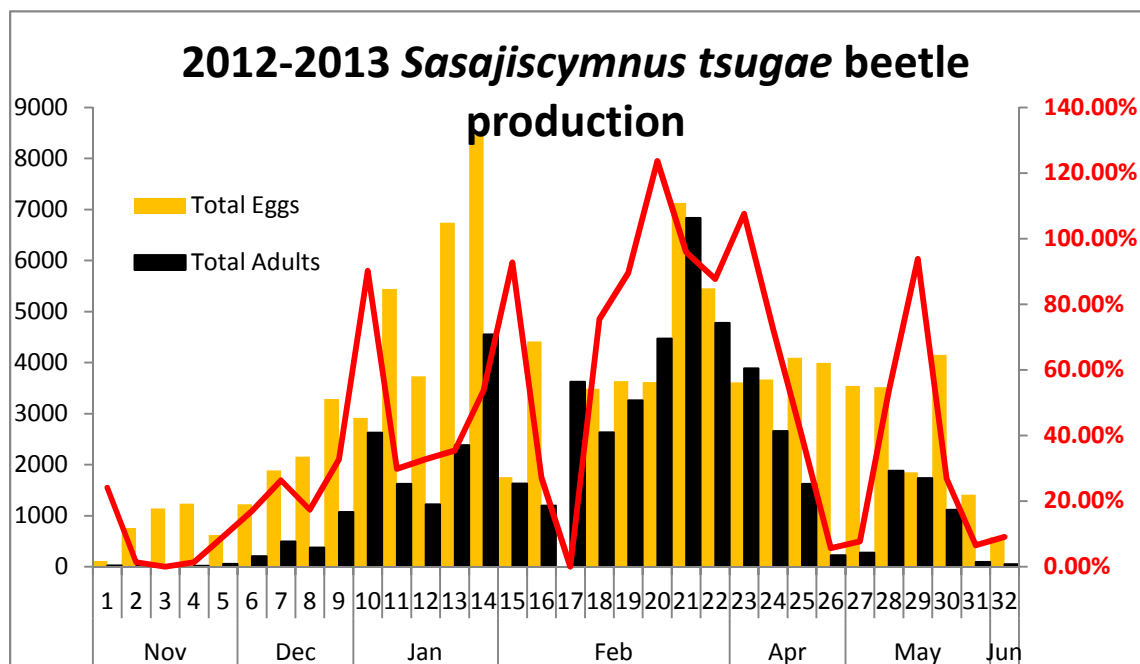


**Figure 4** Dead hemlock trees, Linville Gorge, NC, 2012

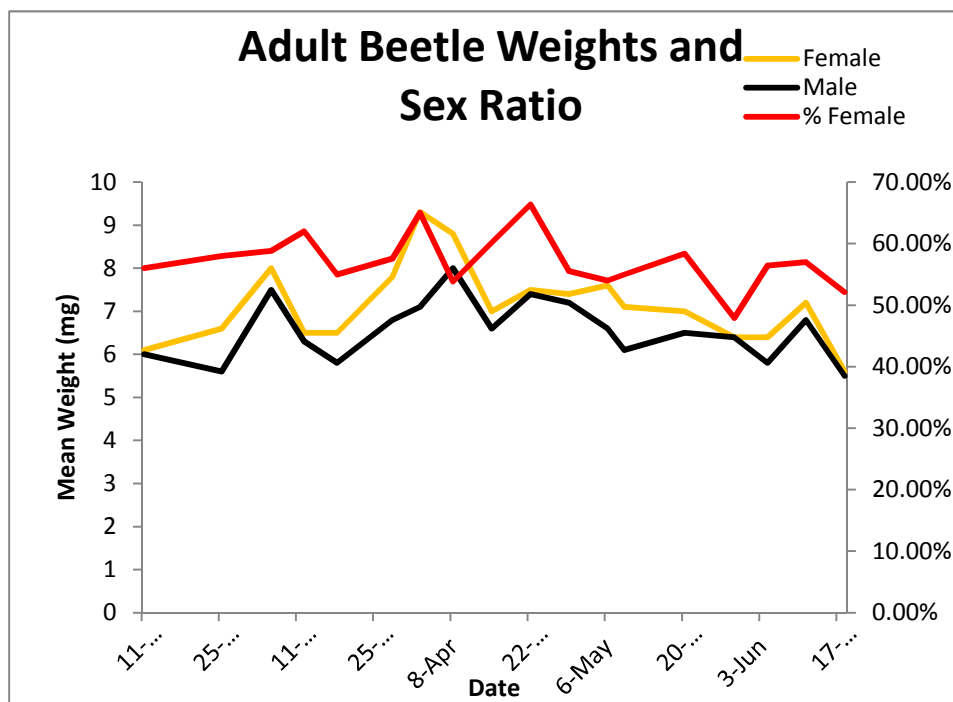
**Results.** The results of the season's production are shown in Figure 5. A total of 56,655 beetles were reared. Approximately 30,000 were transferred to the USDA Forest Service and 10,000 beetles were sent to the Maine Department of Forestry for release. The remaining beetles are being maintained at the lab. During the 2012-2013 rearing season, HWA quality was variable, primarily due to weather conditions. Adelgids developed very quickly during the mild winter, compressing the rearing season. Oviposition by *St* peaked during the *sistens* generation oviposition period in January, but the return of adult beetles was much lower than in past years. Peak adult production occurred during the oviposition period of the adelgid *progreiens* generation beginning in March. These results are inconsistent with past years' production, when the best production came earlier in the season.

Females beetles were slightly larger than males, ( $df=1$ ,  $F = 52.6$ ,  $p < 0.0001$ ), with a mean weight of  $7.2\text{mg} (\pm 0.1 \text{ SEM})$  for females compared to  $6.6\text{mg} (\pm 0.1 \text{ SEM})$  for males (Figure 6). The samples had slightly more females than males with a mean of  $57.4\% (\pm 0.9 \text{ SEM})$  females compared to  $42.9 (\pm 0.6 \text{ SEM})$  males ( $df = 1$ ,  $F = 83.6$ ,  $p < 0.0001$ ).

Personnel assigned to the project during the 2012-13 rearing season include Anitha Boniface, Research Specialist, full time, Rebecca Fergus, Research Specialist  $\frac{3}{4}$  time, and Jimmy Cheatham and Saritha Dharanikota Research Specialists, temporary employees.



**Figure 5** Egg and adult production, *Sasajiscymnus tsugae*, 2012-2013, NCDA&CS.

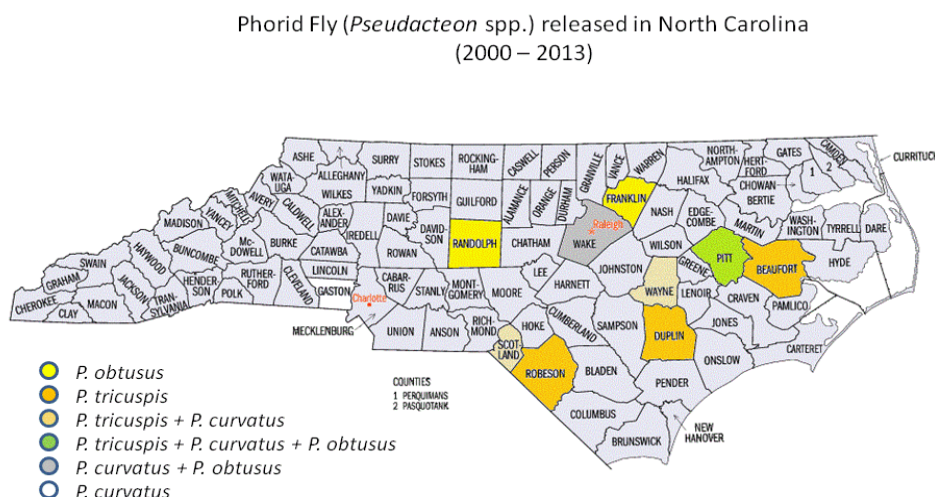


**Figure 6** *Sasajiscymnus tsugae* weights (mg) and proportion of females, 2013, NCDA&CS.

## **Field Release and Monitoring Phorid Flies for Management of Imported Fire Ant**

Rebecca Norris and Kathleen Kidd

Since the discovery of the imported fire ant (IFA) in NC in 1953 it has spread to 70 of 100 counties (NCDA&CS, 2013). In an effort to slow the spread and decrease population size, phorid flies, *Pseudacteon* spp. (Diptera: Phoridae) a natural enemy of the IFA, have been released in NC beginning in 2000, through cooperative efforts between NCDA&CS and USDA. The phorid fly, sometimes referred to as the decapitating fly, lays individual eggs into worker ants while they forage or defend their mounds. After hatching, the fly larva moves into the ant's head to feed, and secretes an enzyme that causes the ant's head to fall off. When phorid flies are present, ants decrease foraging to avoid the flies. Less foraging activity results in fewer ants and smaller and/or fewer mounds, allowing native ants and other insects to better compete for resources.



**Figure 7** Phorid fly releases by species.

**Releases.** Since 2000, four species of phorids, *Pseudacteon tricuspis*, *P. curvatus*, *P. obtusus* and *P. cultellatus* have been released in the state (Figure 7). The species of phorid flies selected for release at each locality was based on the most prevalent type of ant colonies present: monogyne colonies with one queen or polygyne colonies with multiple queens (Table 3). *P. tricuspis* and *P. obtusus* flies typically attack larger workers usually found in the monogyne colonies whereas *P. curvatus* and *P. cultellatus* show a preference for smaller workers common to polygyne colonies (Morrison et al. 1997).

In 2013, fire ants were collected from two sites in Wake County (Table 3), and sent to the USDA ARS-CMAVE phorid fly rearing lab in Gainesville, Florida to be parasitized by the phorid flies *P. obtusus* and *P. cultellatus*. After exposure to the phorid fly the ants were shipped back to NC and released into the mounds from which they were taken. Approximately 1400 *P. obtusus*, 2600 *P. curvatus*, and 6000 *P. cultellatus* were released at two locations.

**Table 3** Site information for *Pseudacteon* releases.

County	Year	Species	GPS Coordinates
Beaufort	2000	<i>Pseudacteon tricuspis</i>	35°41'53.52"N – 77°08'37.40"W
Duplin	2002	<i>Pseudacteon tricuspis</i>	34°59'37.97"N – 78°08'49.97"W
Robeson	2003	<i>Pseudacteon tricuspis</i>	34°35'49.61"N – 79°05'06.73"W
Wayne	2004	<i>Pseudacteon tricuspis</i>	35°23'26.95"N – 78°01'43.95"W
	2008	<i>Pseudacteon curvatus</i>	35°23'26.95"N – 78°01'43.95"W
Wake	2005	<i>Pseudacteon curvatus</i>	35°47'24.89"N – 78°45'10.99"W
	2013	<i>Pseudacteon cultellatus</i>	35°45'42.95"N – 78°40'47.55"W
	2013	<i>Pseudacteon obtusus</i>	35°00'19.49"N – 78°32'06.16"W
Pitt	2006	<i>Pseudacteon tricuspis</i>	35°41'48.37"N – 77°30'32.99"W
	2010	<i>Pseudacteon obtusus</i>	35°37'54.71"N – 77°19'54.21"W
	2010	<i>Pseudacteon curvatus</i>	35°37'54.71"N – 77°19'54.21"W
Scotland	2007	<i>Pseudacteon tricuspis</i>	34°51'05.83"N – 79°32'22.92"W
		<i>Pseudacteon curvatus</i>	34°51'05.83"N – 79°32'22.92"W
Gaston	2009	<i>Pseudacteon curvatus</i>	35°10'54.46"N – 81°06'30.08"W
Randolph	2011	<i>Pseudacteon obtusus</i>	35°37'17.46"N – 79°45'19.32"W
Franklin	2012	<i>Pseudacteon obtusus</i>	36°04'15.93"N – 78°32'22.68"W

**Surveys (2013).** A modified version of sticky traps developed by Puckett et. al. (2007) was used to monitor for *P. obtusus* in Randolph and Franklin County. The traps consist of plastic tri-stands (used to keep the pizza from sticking to the delivery box) glued to 60 x 15 mm plastic petri dishes. The pizza tri-stand and sides of the petri dishes were coated with Fluon™ to prevent the fire ants from escaping and climbing the tri-stand. Inverted tri-stands were anchored to the single tri-stand with Velcro, and the legs of the inverted stands were coated with Tanglefoot® (Figure 8). Traps were placed at or near the fire ant mounds and baited with live and crushed ants and bits of hotdogs to attract phorids. Flies became ensnared in the Tanglefoot® when they alighted to rest on the upright legs.

**Monitoring for *P. obtusus*.** Surveys for the phorid flies in both Randolph and Franklin County were conducted in September. A total of 16 traps in Randolph County and 20 traps in Franklin County were placed in the field at one week intervals, on or near mounds where *P. obtusus* was released. Traps were retrieved one to two days after placement in the field. Flies collected were identified using ovipositor morphology.

**Results.** In Randolph County only *P. curvatus* was present on traps. There were not as many large mounds present this year due to control treatments or dry weather. In Franklin County both *P. obtusus* and *P. curvatus* were found on the traps. All the traps had *P. curvatus* present and 15 out of 20 traps were positive for *P. obtusus*. The total number of phorid flies found on sticky traps was 236; 58 of these were *P. obtusus* and 178 were *P. curvatus*. This site has a high population of monogyne mounds which *P. obtusus* prefers. This site will be monitored in the future, and if



**Figure 8** Sticky trap for capturing phorid flies.



the monogyne remains the predominant IFA type, *P. obtusus* population will increase and spread beyond the release site. Monitoring for *P. obtusus* and the newly released species *P. cultellatus* in Wake County will start in the fall of 2014 after the phorid fly populations have time to increase.

## References

Morrison, L. W., Dall'Agilo-Holvorcem, C. G., and Gilbert, L. E. 1997. Oviposition behavior and development of *Pseudacteon* flies (Diptera: Phoridae), parasitoids of *Solenopsis* fire ants (Hymenoptera: Formicidae). Environ. Entomol. 26: 716-724.

NCDA & CS Plant Industry Division - Red Imported Fire Ant –  
[www.ncagr.gov/plantindustry/Plant/entomology/documents/FireAntmap2010.pdf](http://www.ncagr.gov/plantindustry/Plant/entomology/documents/FireAntmap2010.pdf)

Puckett, R. T., Calixto, A., Barr, C. L., and Harris, M. 2007. Sticky traps for monitoring *Pseudacteon* parasitoids of *Solenopsis* fire ants. Environ. Entomol. 36: 584-588.

### **Kudzu Bug Egg Parasitoid Survey 2013**

The kudzu bug or bean plataspid (*Megacopta cribraria*) is a member of the family Plataspidae. Native to Asia, it is related to stink bugs, and it is the only species of plataspid found in the continental US. Its preferred host is the invasive vine kudzu (*Pueraria montana*), although it will feed on other legumes, including soybean (*Glycine max*).

Kudzu bugs were first identified in Georgia in 2009, and they spread rapidly through Georgia and South Carolina during the summer of 2010. The first report in North Carolina occurred in the fall of 2010, and was at only one site in Macon County in western NC. By the summer of 2011, surveys showed the kudzu bug to be present in approximately  $\frac{3}{4}$  of North Carolina's counties, mostly on kudzu, and in low numbers. By the end of 2012, kudzu bugs had been reported in almost all counties, and were found on host plants, and aggregating on buildings. The kudzu bug is distributed across Asia, but genetic studies indicate that the population in the United States originated from a single population in Japan.

Adults are globular with blunt ends (almost cubical) and light brown to olive green in color (Figure 9). Nymphs are pale green when small and become darker in later instars. They are oval, flat, and appear to have a serrated edge. The youngest nymphs are well camouflaged on the hairy stems of kudzu and soybeans. Eggs are laid on the foliage or stems, and are usually laid in a double row. The bug has a bacterial endosymbiont to aid its digestion, and small packets containing this bacterium are placed between the rows of eggs by the ovipositing female. Upon hatching, nymphs feed on the packets to acquire the symbiont, and then develop through five nymphal stages before becoming adults (Figure 10). Symbiont packets are visible between the rows of eggs.

Most feeding by adults and nymphs occurs on stems and petioles. Being true bugs, they feed by sucking plant juices through needle-like mouthparts, leaving dark lesions at the feeding sites. Kudzu bugs typically pass their first generation in kudzu, and move to soybeans or other legumes in late June – early July to produce a second generation.



**Figure 9** Kudzu bug adults and nymphs.



**Figure 10** Kudzu bug egg mass with newly hatched nymphs

Although the kudzu bug feeds on an invasive weed, its taste for soybean, ability to build up large numbers quickly in crop plants, and its nuisance qualities have led to the search for a long term lasting solution. Soon after the kudzu bug was reported in Georgia, researchers with the USDA-Agricultural Research Service and the University of Georgia began looking at parasitoids that attack it in Asia. *Paratelenomus saccharalis* was selected for its host specificity and high level of attack, and quarantine studies were undertaken. In cooperation with researchers in North Carolina and other southern states, we conducted a survey of kudzu bug eggs, monitoring a population to determine if any native or adventive parasitoids or predators attacked them.

Between 8 May and 19 June, kudzu bug eggs were surveyed at one site on the grounds of the NCDA&CS Beneficial Insects Lab. Samples were taken weekly and consisted of counting and collecting egg masses on 25 1m long terminals. This was followed by one or two sets of 10 sweeps using a 15 in sweep net. Insects collected by sweeping were returned to the lab, cooled, and then the kudzu bug nymphs and adults were counted. Egg masses were examined under a dissection microscope, and the number of eggs hatched and total numbers were recorded for each mass. Egg masses were held in petri dishes at 25 C for a total of 2 weeks, and monitored for hatching during that period.

In the field, 1266 egg masses were counted, but when the samples were examined in the lab, more egg masses were found. The difference was caused by the insects placing separate egg masses either on top of another or adjacent to one another. Individual masses could be determined by orientation and coloration (Figure 11). In the lab, a total of 1,552 egg masses were examined (Table 4, Figure 12) over the study (range = 114 – 318 per week). Adult numbers peaked on 15 May, but nymphs did not peak until 12 June. Peak numbers of eggs were found between 22 May and 5 June. Eighty percent of the eggs hatched within two weeks (range 73-85%). No egg parasitoids were found.

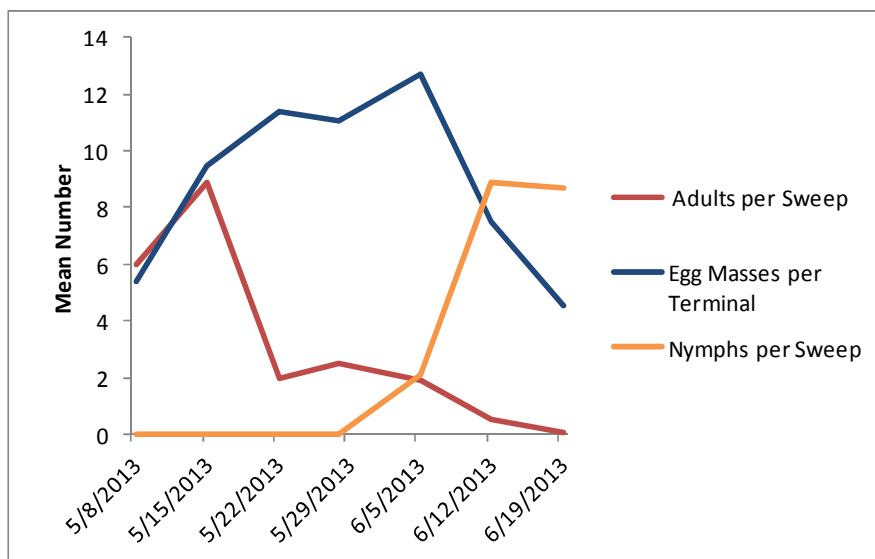
The field plot was monitored for a new generation of bugs, but very few eggs were found. Although no comparative plots are available, kudzu bug populations appeared to negatively impact the kudzu plot. Feeding lesions on the vines were prominent, and terminal growth was slender and threadlike rather than stout and robust.



**Figure 11** Multiple egg masses laid in layers.

**Table 4** Lab counts of kudzu bug egg masses

	8 May	15 May	22 May	28 May	5 June	12 June	19 June
Total # egg masses	137	237	284	277	318	187	114
Mean # masses per terminal	5.48	9.48	11.36	11.08	12.72	7.48	4.56
Mean eggs per egg mass	15.6	14.7	11.5	11.8	11.1	10.7	10.6



**Figure 12** Kudzu bug egg masses, nymphs, and adults, Cary, NC 2013.

#### Selected internet references:

<http://www.kudzubug.org/> The kudzu bug Working Group page.  
<http://www.gabugs.uga.edu/documents/KudzuBugCircular991.pdf> (Two page extension guide for homeowners).  
<http://www.gabugs.uga.edu/documents/M.cribrariaArticleForYourRecords.pdf> (Journal article on discovery in GA with basic biological information, an expanded version of the above note).  
<http://www.gabugs.uga.edu/documents/Egeretal2010.pdf> (Journal article (Insecta Mundi) about kudzu bugs. (A good review of biology).

### **Mile-A-Minute Vine Biological Control**

In the fall of 2010, an infestation of mile-a-minute vine (MAM) (*Persicaria perfoliata*) was reported in Alleghany County (Poindexter 2010). Subsequently, additional locations were reported by citizens or through a survey of herbaria specimens. In cooperation with the NCDA&CS Weed Program, delimiting surveys were conducted by Plant Industry Field Specialists, and showed several concentrations of the weed, primarily along the drainage of Elk Creek. The extensive distribution of MAM in Alleghany County, its growth in the midst of native plants, and its preference for riparian habitat made this weed an ideal target for biological control. Although some roadside stands were designated for herbicide treatment, other areas along the creek were selected for biological control using a weevil, *Rhinoncomimus latipes*. The weevils have been introduced in several states from Virginia to Massachusetts, and successfully established in those areas.

Mile-a-minute vine and the weevil are native to China. The weevil was identified by entomologists from the USDA Forest Service and the University of Delaware searching for agents to control MAM (Hough-Goldstein et al. 2008). The weevil is host-specific and during extensive lab and field testing did not complete its development on other plants, even those closely related to MAM. The weevils are now being reared at the Philip Alampi lab of the New Jersey Department of Agriculture (NJDA). Beginning in May 11, 2011 weevils have been released and monitored for establishment and spread of the weevils. In 2012, an April freeze killed many of the seedlings resulting in smaller populations. Heavy rains and milder temperatures in the spring of 2013 led to large populations of MAM; high water levels deposited silt (and likely seeds) in the flood plain of Elk Creek, encouraged germination of seeds, and left some areas scoured clean of other vegetation. We saw our densest populations in three years (Figure 13). We released 2000 beetles on July 25, 2013 in the Hawksnest Way area and 1000 weevils in the Osborne Memorial Road area on August 15. Before releases were made, we were able to find overwintered beetles at all sites. During an early spring visit to Yancey County, no MAM plants were found near the release site along Coxes Creek. None were found during 2012. During August and September additional reports of MAM infestations were confirmed in Guilford, Rockingham, Gates, Perquimans, and Pasquotank Counties. We plan to work with the NJDA to obtain additional weevils to release in these sites.



**Figure 13** Mile-a-minute vine, Alleghany County, August 15, 2013

### **References Cited**

Hough-Goldstein, J., E. Lake, R. Reardon, and Y. Wu, 2008a. [Biology and Biological Control of Mile-a-minute Weed. USDA Forest Service, FHTET-2008-10.](#)

Poindexter, D.B. 2010. *Persicaria perfoliata* (Polygonaceae) reaches North Carolina. Phytoneuron. 30: 1-9.

### **Acknowledgments**

Numerous people contributed to this project, including Rebecca Norris, Kathy Kidd, Weed Specialist Rick Iverson, Field Specialists Chad Taylor, Tim Hartley, Daniel Overcash and Chris Elder, and homeowners the Wellens, Walters, and Blums.



## **Cooperative Agriculture Pest Survey (CAPS) Program**

The Cooperative Agricultural Pest Survey (CAPS) is a joint initiative between the United States Department of Agriculture USDA-APHIS-PPQ and the NCDA&CS to fund and implement domestic surveys of harmful or economically significant plant pests and weeds that have not been detected by front-line inspections at our ports of entry. These surveys safeguard our nation's agricultural and natural resources by detecting introductions or early pest infestations which are of concern to our trading partners. Typical surveys target exotic pests, pests of export significance, and pests that are not known to occur in the U.S., but can also include regionally established pests. A strong domestic pest detection infrastructure and headquarters/regional staff is vital to ensuring that scientifically valid, current, and reliable pest/disease survey data is available on a continuing basis. Additionally, staff support is also critical at the state level, and federal funding provides for a State CAPS Survey Coordinator (SSC) position housed within the NCDA&CS Plant Industry Plant Protection Section.

### **Summary**

In total, 440 individual samples were sorted from traps during 2013. Five surveys were conducted: Exotic Woodborer and Bark Beetle, Oak Commodity, Grape Commodity, Asian Defoliators and Solanaceous Commodity (ongoing). All surveys were conducted by NCDA&CS personnel. The 2013 season brought the detection of Emerald Ash Borer in our state. Positive confirmation by PPQ prompted the pest's entry into the National Agricultural Pest Information System (NAPIS), and as a result, four counties (Granville, Person, Vance and Warren) are now under state and federal quarantine.

The North Carolina (NC) CAPS advisory committee met July 30<sup>th</sup> to plan survey objectives for the upcoming 2014 season. The team consisted of the core members of the state CAPS committee as well as members from North Carolina State University, NC Forest Service and other members from NCDA&CS. The survey season for 2014 was determined and plans were made so survey overlap would be minimal or non-existent. New survey suggestions were submitted through CAPS and Farm Bill before year's end.

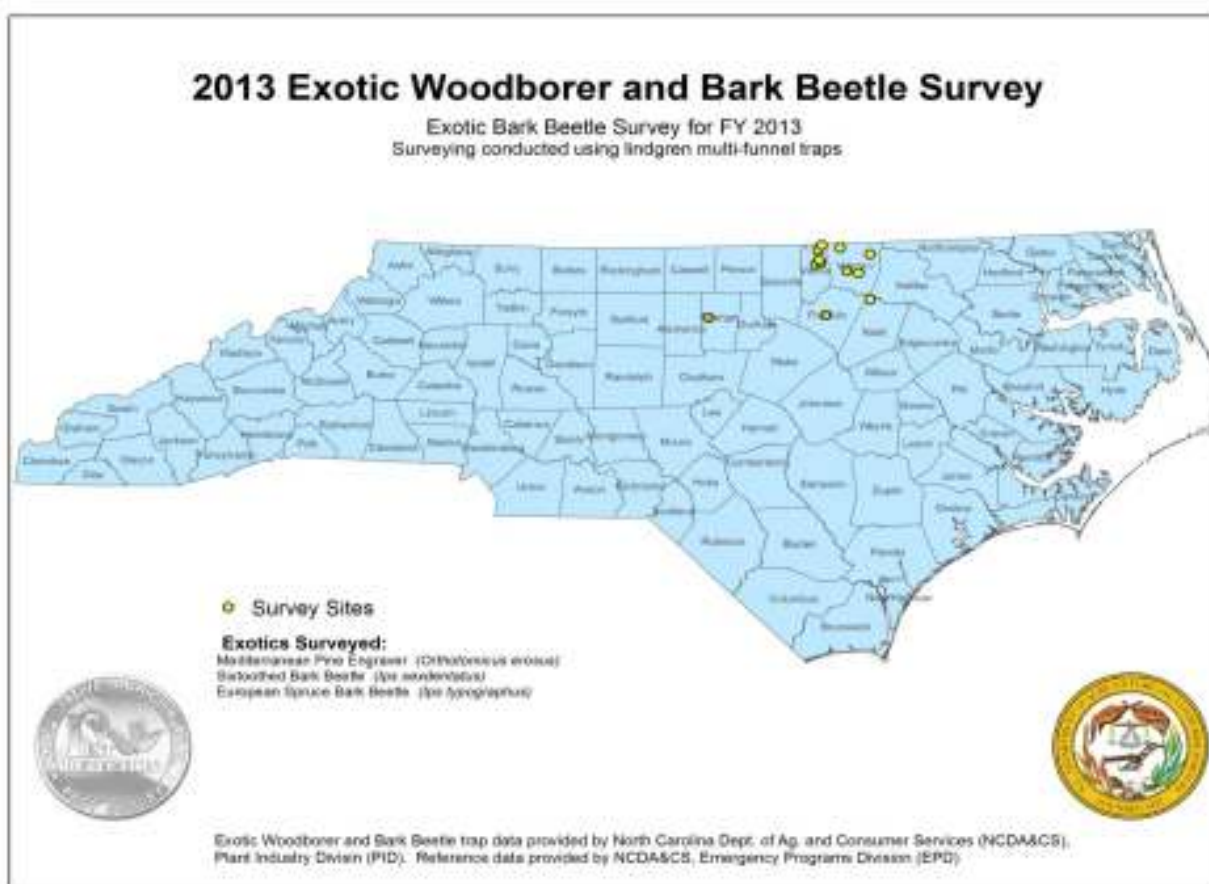
To improve CAPS survey efficiency and to cover more ground during the survey season, the state was divided into thirds (East, Central and West). Three Plant Pest Aides (PPA) were hired for 2013, each with their own territory. This has given the NC CAPS program more flexibility and greater efficiency in conducting its surveys, without employing NCDA&CS Field Specialists who are already tasked with other endeavors.

The SSC assisted the Weeds Specialist in surveying for exotic and invasive weeds in August and September. Additional data was entered into NAPIS for positive identification of Tropical Soda Apple (*Solanum viarum* Dunal), Mile-a-minute vine (*Persicaria perfoliata*), Cogongrass (*Imperata cylindrical*) and Giant hogweed (*Heracleum mantegazzianum*).

Four surveys (Exotic Woodborer and Bark Beetle, Oak Commodity, Asian Defoliators and Grape) were completed during the 2013 surveying season. The season began in February with the Exotic Woodborer and Bark Beetle survey.

### Exotic Woodborer and Bark Beetle

North Carolina was engaged in the Exotic Woodborer and Bark Beetle survey for the 2013 season. Several bark beetles that were targeted: the Six-toothed Bark Beetle (*Ips sexdentatus*), European Spruce Bark Beetle (*Ips typographus*) and Mediterranean Pine Engraver (*Orthotomicus erosus*) (Figure 14). Specimens were identified with help from the North Carolina State University (NCSU) Plant Disease and Insect Clinic (Table 5). In addition, Oak Splendor Beetle (*Agrilus biguttatus*) and European Wood Wasp (*Sirex noctilio*) were also surveyed (Figure 15 and Figure 16 respectively). These are serious pests that pose a threat to North Carolina forests and timber industry. Trapping for the Exotic Woodborer and Bark Beetle survey began in February and lasted throughout the survey season (September). The timing of trap placement was dependent upon the target species. The Exotic Woodborer and Bark Beetle survey focused on state parks, rest stops and other private and public land. **No target species were observed or determined to be positive in any of the screened samples for these surveys.**

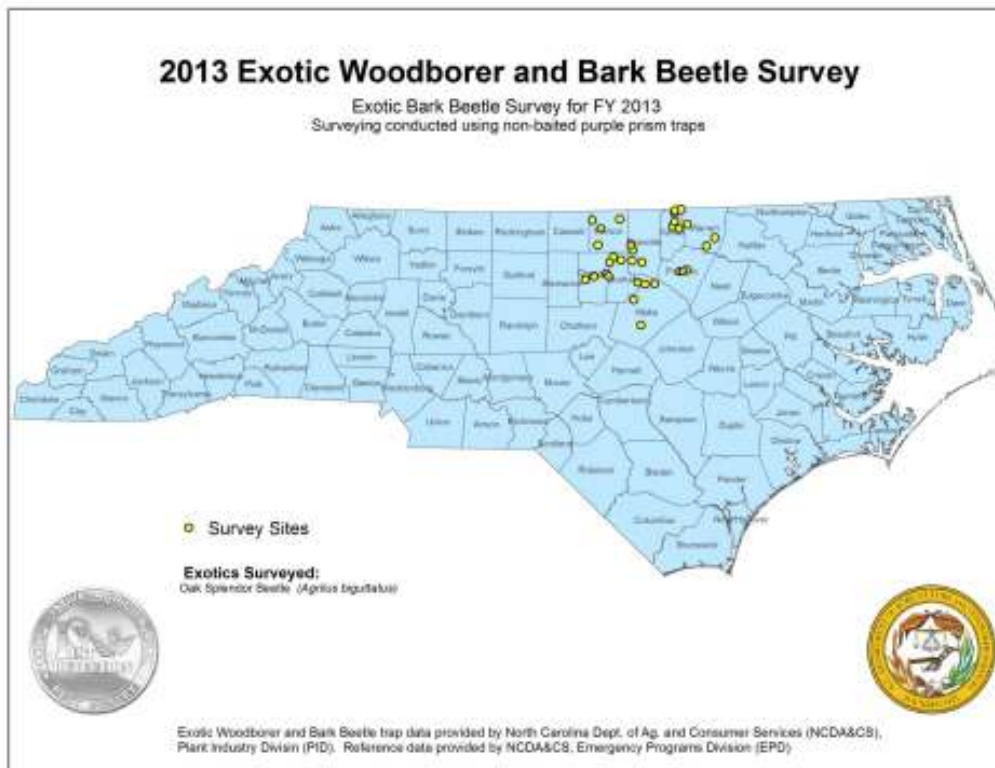


**Figure 14** 2013 Exotic Woodborer and Bark Beetle survey locations.

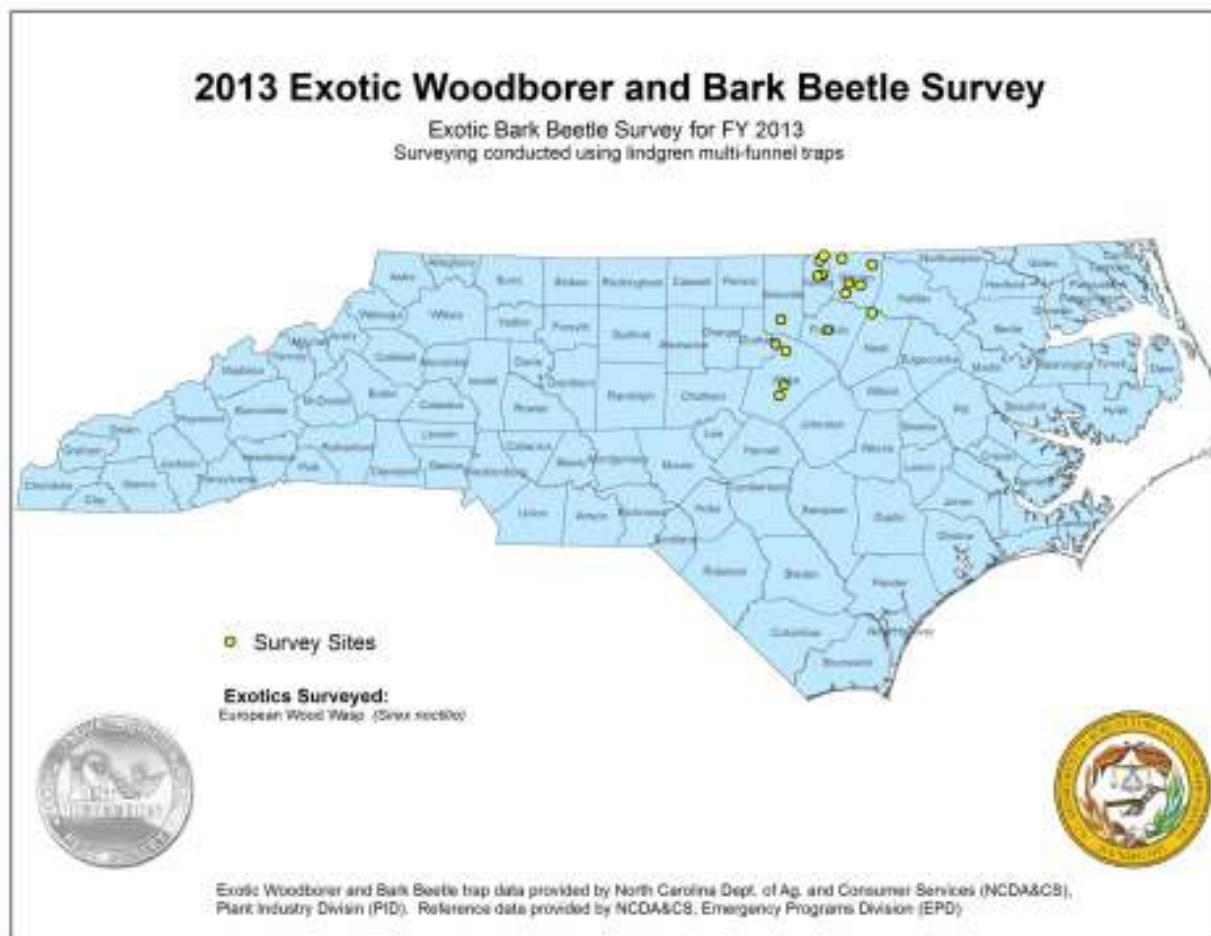
A total of 12 trapping locations completed the survey for the targeted pests including Six-toothed Bark Beetle (*Ips sexdentatus*), European Spruce Bark Beetle (*Ips typographus*) and Mediterranean Pine Engraver (*Orthotomicus erosus*).

**Table 5** Identification of all bark beetle specimens after initial sorting.  
 Specimens were identified with help from the NCSU Plant Disease and Insect Clinic.

Species list	# Specimens/Species
<i>Cyclorhipidion bodoanum</i> [= <i>Xyleborus californicus</i> ]	1
<i>Cyclorhipidion pelliculosum</i> [= <i>Xyleborus pelliculosus</i> ]	1
<i>Dendroctonus terebrans</i>	1
<i>Dryoxylon onoharaensis</i>	1
<i>Orthotomicus caelatus</i>	1
<i>Xylosandrus crassiusculus</i>	1
<i>Euwallacea validus</i>	2
<i>Oxoplatypus quadridentatus</i>	2
<i>Trypodendron scabricollis</i>	2
<i>Monarthrum mali</i>	6
<i>Monarthrum fasciatum</i>	11
<i>Gnathotrichus materiarius</i>	46
<i>Xyleborinus saxesenii</i>	101
<i>Ips calligraphus</i>	102
<b>14 species</b>	<b>278 specimens</b>



**Figure 15** 2013 Exotic Woodborer and Bark Beetle survey locations.  
 A total of 34 trapping locations completed the survey for the targeted pest Oak Splendor Beetle (*Agrilus biguttatus*).



**Figure 16** 2013 Exotic Woodborer and Bark Beetle survey locations.  
 A total of 17 trapping locations completed the survey for the targeted pest European Wood Wasp (*Sirex noctilio*).

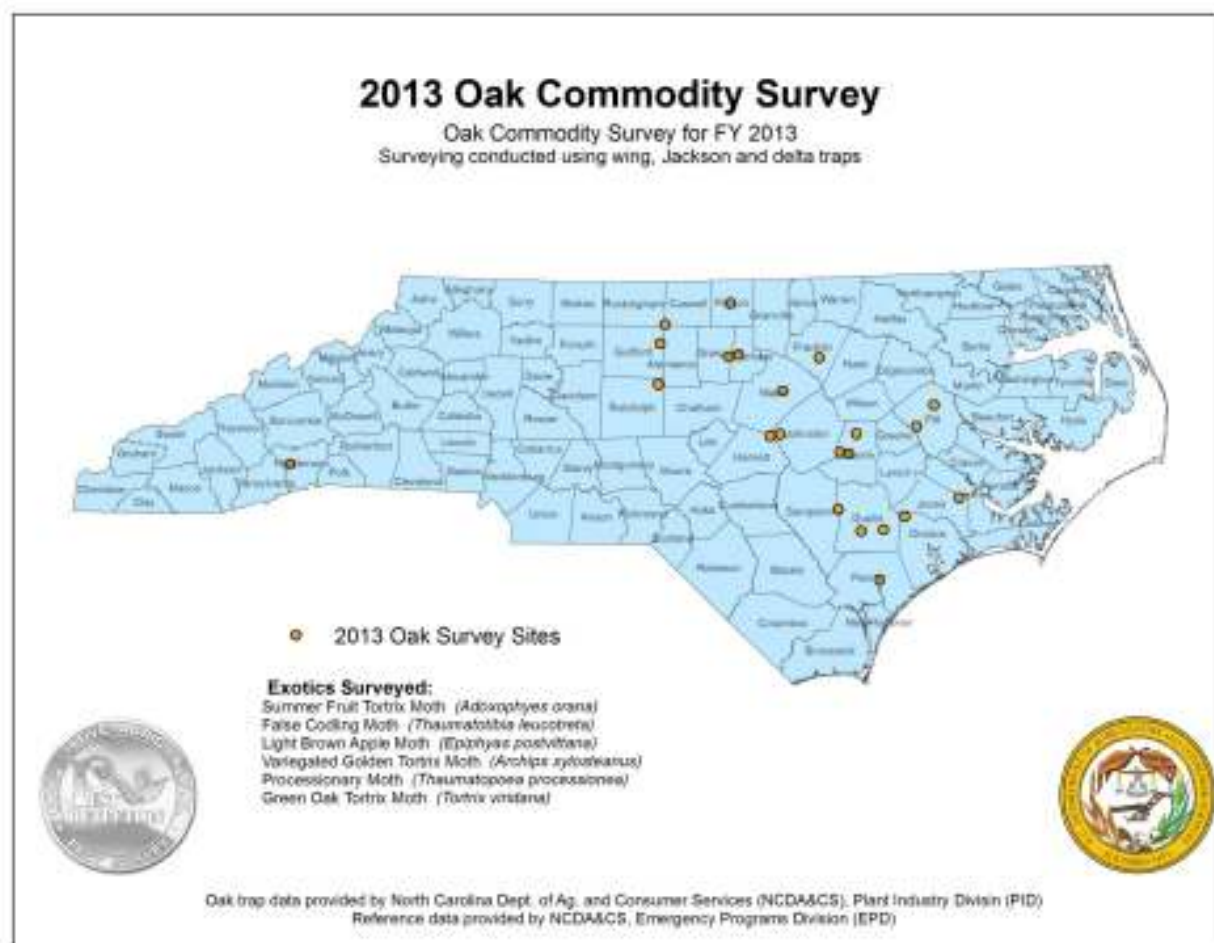
### **Oak Commodity Survey**

Under the oak commodity, North Carolina surveyed for Light Brown Apple Moth (*Epiphyas postvittana*), Summer Fruit Tortrix Moth (*Adoxophyes orana*), Green Oak Tortrix Moth (*Tortrix viridana*), Variegated Golden Tortrix Moth (*Archips xylosteanus*), False Codling Moth (*Thaumatotibia leucotreta*) and Oak Processionary Moth (*Thaumtopoea processionea*). The oak commodity trapping season began in April and lasted through September.

Combined, this group of invasive pests represents a significant threat to the economic, agricultural, and environmental well-being of North Carolina. Together, they have an impressive host range and include nursery stock, cut flowers, stone fruits (peach, plum, cherry, etc.), pome fruits (apple and pear), grape, elm, ash, maple, oak, blackberry, cotton, honeysuckle, lilac, rose, strawberry, blueberry, rhododendron, corn, okra, pepper, sorghum and other host species.

This survey utilized several trap types including the Jackson (Light Brown Apple Moth), delta (Summer Fruit Tortrix Moth), and wing (False Codling Moth, Variegated Golden Tortrix Moth, Green Oak Tortrix Moth and Processionary Moth) traps baited with pheromone.

Traps were placed in nurseries that sell the oak commodity throughout North Carolina. A total of 18 locations were selected across fifteen counties (Figure 17). At the time of servicing for lure replacement, samples were also taken and sorted by the SSC with help from the state entomologist. **No target species were observed or determined to be positive in any of the screened samples for this survey.**



**Figure 17** 2013 Oak Commodity survey locations.

A total of 18 trapping locations completed the survey for the targeted pests including Light Brown Apple Moth (*Epiphyas postvittana*), Summer Fruit Tortrix Moth (*Adoxophyes orana*), Green Oak Tortrix Moth (*Tortrix viridana*), Variegated Golden Tortrix Moth (*Archips xylosteanus*), False Codling Moth (*Thaumatotibia leucotreta*) and Oak Processionary Moth (*Thaumatopoea processionea*).

### **Asian Defoliators**

Survey locations for Asian Defoliators were concentrated at Ports of Entry (POE), military installations and highway rest stops. Introduction of these exotics would have serious implications for North Carolina forests.

Two exotic species were surveyed (Figure 18); Asian Gypsy Moth (*Lymantria dispar asiatica*) and Nun Moth (*Lymantria monacha*). Both exotics can attack hardwood and coniferous trees and are considered serious pests in Europe (*L. monacha*) and Asia (*L. dispar asiatica* and *L. monacha*). Host trees for these pests are considered economically important and include oak, pine, ash, elm, maple and



walnut. Traps were placed in June and pulled in September. **No target species were observed or determined to be positive in any of the screened samples for this survey.**



**Figure 18** 2013 Asian Defoliators survey locations.

A total of 13 trapping locations completed the survey for the targeted pests including Asian Gypsy Moth (*Lymantria dispar asiatica*) and Nun Moth (*Lymantria monacha*). New Hanover County had three trapping locations all located within the Port of Wilmington, however due to the scale of the map only one location appears.

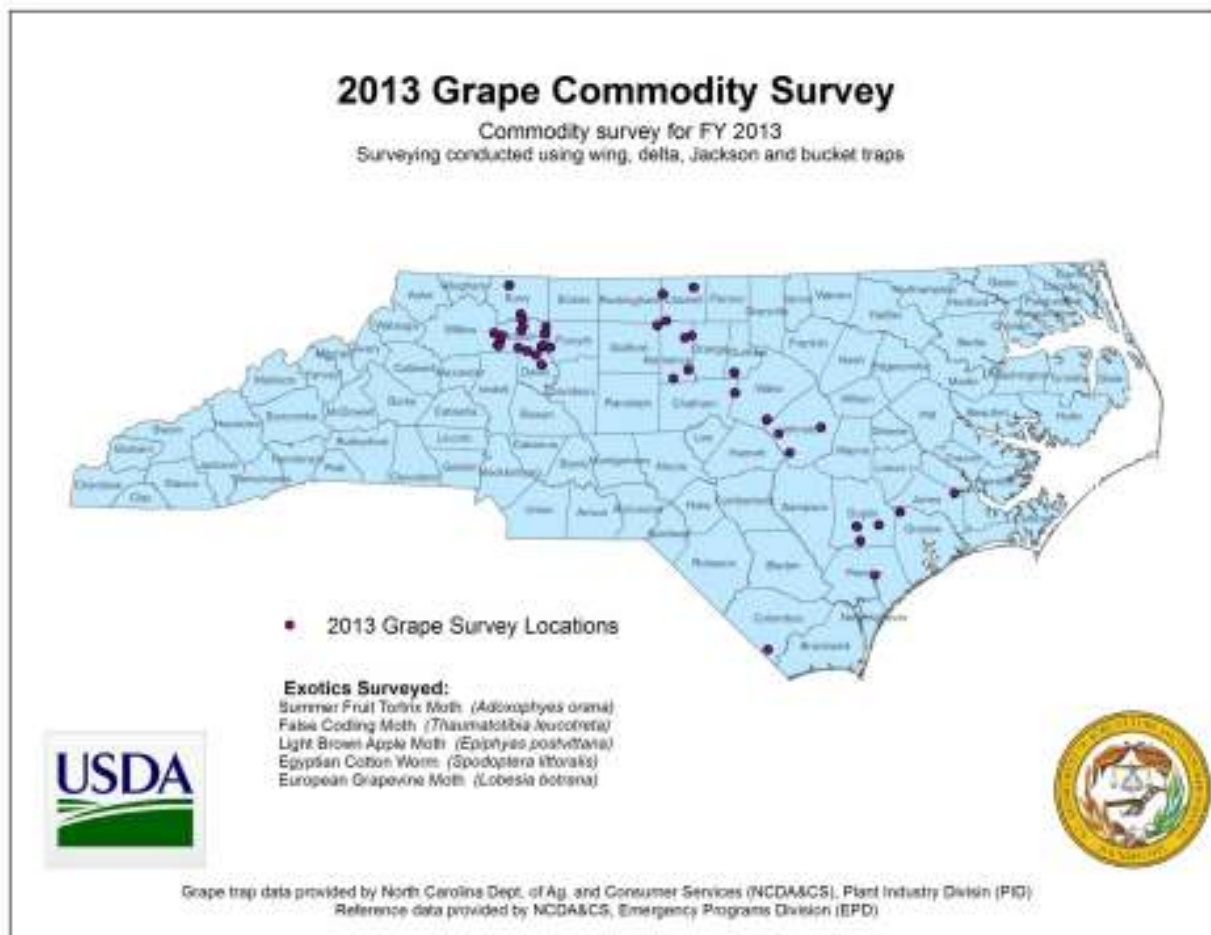
### **Grape Commodity**

Ranked 10<sup>th</sup> in the country by production in 2011 (5,200 tons), the grape industry in North Carolina continues to grow (2012 NASS). In addition to the traditional wine grape (*V. vinifera*) North Carolina also produces the muscadine grape (*V. rotundifolia*). Under this survey five exotic species were trapped including Summer Fruit Tortrix Moth (*Adoxophyes orana*), False Codling Moth (*Thaumatotibia leucotreta*), Light Brown Apple Moth (*Epiphyas postvittana*), Egyptian Cotton Worm (*Spodoptera littoralis*) and European Grapevine Moth (*Lobesia botrana*) using delta, wing, Jackson and bucket traps. Traps were placed in June and pulled in September.

Survey locations were concentrated in the Central/Western portion of North Carolina (Figure 19), with the majority being placed in Yadkin County, reflecting the state's concentration of vineyards. Forty-two trapping locations were set up across 16 counties over a four month period for the aforementioned pests.



One species of *Spodoptera* was observed and was sent to the NCSU Plant Disease and Insect Clinic where the specimen was confirmed as *S. ornithogalli*, Yellow-Striped Armyworm. **No target species were observed or determined to be positive in any of the screened samples for this survey.**



**Figure 19** 2013 Grape survey locations.

A total of 42 trapping locations completed the survey for the targeted pests including Summer Fruit Tortrix Moth (*Adoxophyes orana*), False Codling Moth (*Thaumatotibia leucotreta*), Light Brown Apple Moth (*Epiphyas postvittana*), Egyptian Cotton Worm (*Spodoptera littoralis*) and European Grapevine Moth (*Lobesia botrana*).

### **Solanaceous Commodity**

A tomato survey was initiated for 2013 and is currently ongoing with a scheduled finish in 2014. This survey is targeting Tomato Leaf Minor (*Tuta absoluta*).

## **Entomological Programs**

The following report describes the most important activities and accomplishments of the NCDA&CS Plant Industry Division Entomological Programs during 2013. It encompasses three major areas including surveys, permits associated with the movement of live insects into the state for commercial, educational and research purposes and, outreach. One of the most important accomplishments of the 2013 season was the development of new systems using mobile technology platforms to improve survey efficiency and field data collection.

### **2013 Movement of Live Insects for Research, Commercial or Educational Purposes**

The NCDA&CS evaluated 78 federal applications, PPQ Permit 526, for the movement of live insects into North Carolina. The large number of applications to move insects to North Carolina reflects the continued market in commercial production, sale, and movement of insects for education, entertainment, and scientific research conducted in North Carolina's academic institutions and the private sector.

### **2013 Blueberry Export Certification Program**

The Canadian Food Inspection Agency requires that all fresh blueberries shipped to Canada come from growers who participate in a Blueberry Certification Program. The program consists of monitoring and control procedures for the blueberry maggot, *Rhagoletis mendax*. Fifty two North Carolina production areas were monitored (5,562 acres total representing 106 fields) throughout the harvesting and shipping period and were issued certification documents. No blueberry maggots were detected in any of the fresh market blueberries being shipped to Canada in 2013.

### **2013 Boll Weevil Eradication Program**

Cotton was grown in 52 counties in North Carolina for a total of 453,075.76 acres during the 2013 season (Table 6 & Table 7). An estimated 8,614 traps were placed in the field by 14 contractors for an average of 60.5 acres/trap. **No boll weevils were captured during the 2013 season.**

**Table 6** Cotton gin numbers surveyed for cotton boll weevil in NC

<b>County</b>	<b>Number of gins</b>	<b>County</b>	<b>Number of gins</b>
<b>Beaufort</b>	1	<b>Lenoir</b>	1
<b>Bertie</b>	2	<b>Martin</b>	1
<b>Chowan</b>	1	<b>Nash</b>	1
<b>Cumberland</b>	1	<b>Northampton</b>	5
<b>Duplin</b>	1	<b>Pasquotank</b>	1
<b>Gates</b>	1	<b>Perquimans</b>	1
<b>Greene</b>	1	<b>Pitt</b>	2
<b>Halifax</b>	4	<b>Robeson</b>	2
<b>Edgecombe</b>	1	<b>Sampson</b>	2
<b>Hertford</b>	1	<b>Scotland</b>	1
<b>Hyde</b>	1	<b>Wayne</b>	1
<b>Jones</b>	1	<b>Wilson</b>	2

**Table 7** Reported cotton acreage in NC during the 2013 season.

<b>County</b>	<b>Acreage</b>	<b>County</b>	<b>Acreage</b>	<b>County</b>	<b>Acreage</b>
<b>Anson</b>	1536.6	<b>Halifax</b>	63314.0	<b>Perquimans</b>	8076.0
<b>Beaufort</b>	12666.4	<b>Harnett</b>	9965.0	<b>Pitt</b>	17314.8
<b>Bertie</b>	27613.7	<b>Hertford</b>	8088.0	<b>Richmond</b>	1238.3
<b>Bladen</b>	6356.7	<b>Hoke</b>	9470.3	<b>Robeson</b>	11666.2
<b>Brunswick</b>	693.4	<b>Hyde</b>	9894.7	<b>Rowan</b>	527.6
<b>Camden</b>	384.2	<b>Iredell</b>	0.0	<b>Rutherford</b>	141.1
<b>Carteret</b>	1928.0	<b>Johnston</b>	6297.0	<b>Sampson</b>	15220.0
<b>Chowan</b>	7349.9	<b>Jones</b>	9074.8	<b>Scotland</b>	5874.9
<b>Cleveland</b>	1832.4	<b>Lenoir</b>	12185.0	<b>Stanly</b>	12290.1
<b>Columbus</b>	4766.8	<b>Lincoln</b>	110.8	<b>Tyrrell</b>	5744.0
<b>Craven</b>	6509.3	<b>Martin</b>	33112.1	<b>Union</b>	1903.7
<b>Cumberland</b>	6126.4	<b>Montgomery</b>	257.6	<b>Wake</b>	819.9
<b>Duplin</b>	7656.9	<b>Moore</b>	254.5	<b>Warren</b>	1821.4
<b>Edgecombe</b>	22290.0	<b>Nash</b>	9662.4	<b>Washington</b>	8739.8
<b>Franklin</b>	239.9	<b>Northampton</b>	35647.9	<b>Wayne</b>	7595.8
<b>Gates</b>	12401.7	<b>Onslow</b>	2794.8	<b>Wilson</b>	13069.2
<b>Granville</b>	396.1	<b>Pasquotank</b>	1337.0		
<b>Greene</b>	8450.4	<b>Pender</b>	368.3	<b>Total</b>	<b>453075.76</b>

## **2013 Outreach Program**

The NCDA&CS-Plant Industry Division in collaboration with the United States Department of Agriculture –Animal Plant Health Inspection Service (USDA-APHIS) started an outreach program in North Carolina as part of a multistate effort to educate the public on the most important invasive forest insect pest species. The main goal of this program, known as the Forest Pest Survey Outreach Program (FPSOP), is to increase the participation of the general public in reporting invasive forest pest species to federal and state agencies. In the first months of the NC-FPSOP, preparations were made to build databases of potential groups to recruit volunteers and provide training in the identification of invasive forest pests. Outreach material was also prepared. Databases of master gardener, hiking clubs, outdoor groups, campgrounds and institutions that might be interested in this project were created. Training was provided in the identification and biology of the most important invasive forest insect pest species including the gypsy moth (*Lymantria dispar*), emerald ash borer (*Agrilus planipennis*), Asian longhorned beetle (*Anoplophora glabripennis*), walnut twig beetle and thousand cankers disease of walnut (*Pytiophthorus juglandis*), and the red ambrosia beetle (*Xyleborus glabratus*) the vector of *Raffaelea lauricola*, the causal agent of Laurel Wilt disease.

Activities and training sessions include:

- a. Display outreach board presented during the Soil and Water Conservation meeting held in Raleigh on January, 6 and 7. An estimated audience of 500 people attended and interacted with us during this event. We were able to establish new contacts and schedule new activities as a result of these contacts including talks and presentations to Boy Scout troops in the area and in different campgrounds.
- b. Formal presentation for the Wake Soil and Water Conservation meeting on February 28, 2013. An estimated 100 people attended this meeting. We provided information on the economic importance, damage, biology and identification of all major forest pests of relevance to NC

- including gypsy moth, emerald ash borer, walnut twig beetle, Asian longhorned beetle and red ambrosia beetle. Emphasis was given on the importance of movement of fire wood and the spread of these pests and, how the general public can help in reporting these invasive species.
- c. Talk presented at the Craven County Extension office to 30 people from the area interested in invasive species.
  - d. Outreach at the 2013 “*NC Bugfest*,” an all day event that took place at the North Carolina Museum of Natural History in Raleigh on September 20, 2013. The event was extremely well attended with an estimated 36,000 people visiting. We set up a booth simulating a campground with North Carolina mountain scenery with the intention to promote the “*Do not move firewood*” message. During this event, we educated a large number of people on the importance of the most destructive invasive forest insect species in North Carolina including emerald ash borer, gypsy moth, walnut twig beetle and others. Our booth got a lot of attention from both kids and adults (Figure 20). We distributed educational material including brochures and “goodies” promoting the “Hungry Pest” website ([www.hungrypest.com](http://www.hungrypest.com)). As part of our educational approach, we also dressed in an EAB costume, a huge success with kids.
  - e. Outreach was also done at the North Carolina State Fair, a 10 day event that showcased North Carolina agriculture. We had the opportunity to interact with a large group of people in a similar fashion as in “*NC Bugfest 2013*.”
  - f. Presentations and talks were given at different Extension Service offices including the Currituck County and Craven County Extension offices. Participants were primarily farmers. Another talk on invasive forest insect species was presented to the Parks and Recreation Service meeting in Raleigh on November 12. Participants were from both North Carolina and South Carolina and included farmers, arborists and city planners among others.



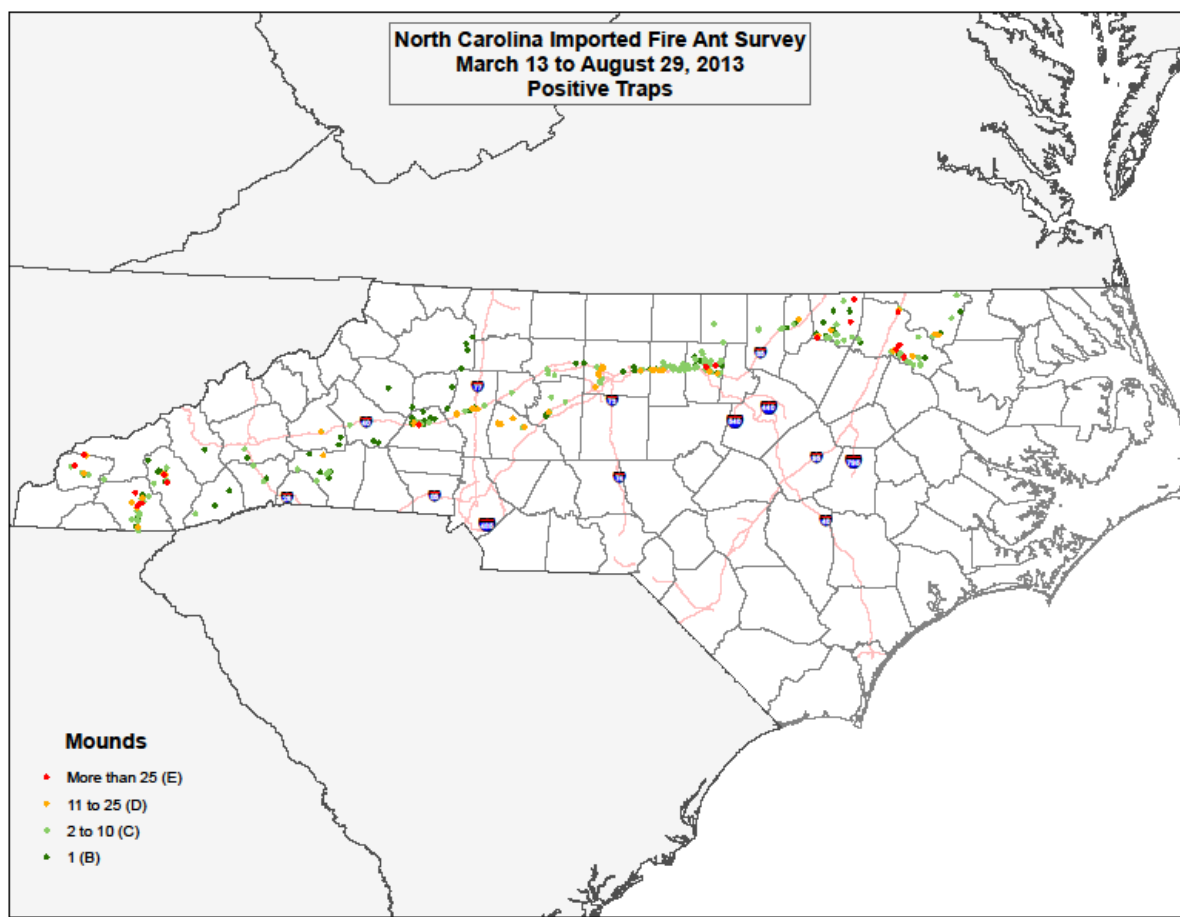
**Figure 20** Outreach at the 2013 "NC Bugfest" at the NC Museum of Natural History  
**Left**, Kelly Otten, from the NC-Forest Service dressed as an EAB is teaching kids about emerald ash borer. **Right**, a simulated campground with a 3-D modular display of the NC mountains and a simulated fireplace with the message “*Do not move firewood*”. The simulated campground was a huge success attracting kids to our display and a great opportunity for parents to take pictures.

### **2013 Imported Fire Ant Survey and Monitoring Program**

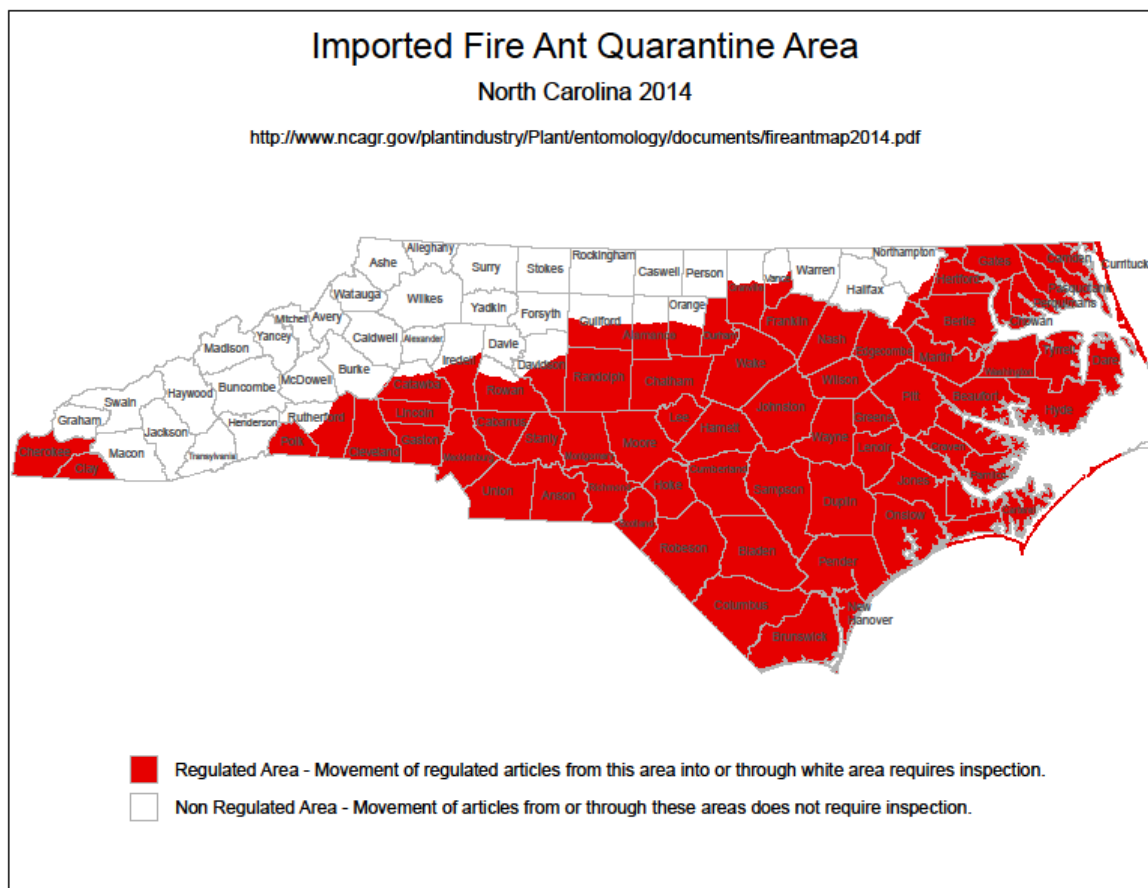
The Imported Fire Ant (*Solenopsis invicta*) (IFA) continues to be a serious pest in the southern United States with infestations occurring in eleven states. North Carolina is on the leading edge of the expanding range of fire ants. Currently, 70 of North Carolina's 100 counties are either partially or entirely infested. NCDA&CS' responsibility is to undertake regulatory actions to prevent the artificial spread of IFA from infested areas to non-infested areas.

#### **Methodology and Results**

Drive-by surveys (visual inspections) were conducted from March to August 2013 in 29 counties along the current IFA quarantined line (Table 8). The results of these surveys are shown in Figure 21. As a result of these surveys, and the 2012 surveys, new areas were added to the IFA quarantine line including Lincoln County and the area of Catawba County south of I-40 (Figure 22). To reinforce federal regulations, IFA blitzes were conducted at the weigh stations in Halifax (I-95 corridor in Halifax County), Mount Airy (I-77 Corridor in Surry County) and Hendersonville (I-26 Corridor in Henderson County). Drivers were asked about IFA regulated articles, and soil samples were collected from regulated articles, processed and sent for chemical analyses (NCDA&CS Food and Drug Protection Division Laboratory) to determine the levels of bifenthrin or any other approved pesticides as required by the federal and state regulations.



**Figure 21** New IFA mounds frequency along the quarantined line in North Carolina.



**Figure 22** New established IFA quarantined lines in 2014 as a result of 2012 and 2013 surveys. Areas added include Lincoln county and the area of Catawba county south of I-40.

**Table 8** Results of 2013 IFA surveys in NC.

County	Miles Surveyed	Contacts Made	Total Acres Surveyed	New Sites Found	New Mounds Found
Alamance	689	14	134	106	180
Alexander	689	9	36	2	2
Buncombe	849	25	48	2	6
Burke	1815	42	94	5	4
Caldwell	902	19	54	2	3
Catawba	1381	47	104	20	93
Davidson	835	13	123	124	36
Davie	399	7	45	60	13
Forsyth	619	21	95	99	30
Graham	651	55	208	10	65
Granville	739	22	70	8	16
Guilford	1005	21	182	160	152
Halifax	2408	82	241	65	310
Haywood	647	51	218	1	1
Henderson	601	53	293	4	45
Iredell	549	12	84	82	84

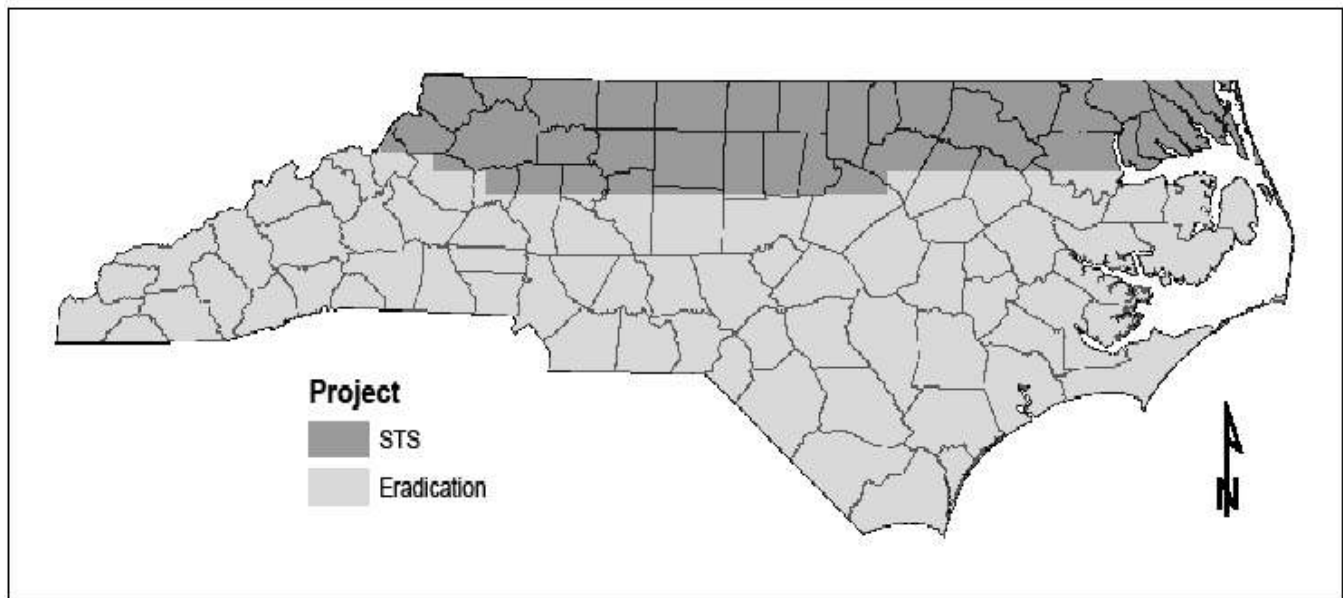


<b>Jackson</b>	1773	134	531	21	127
<b>Macon</b>	1162	128	587	31	406
<b>McDowell</b>	986	27	64	5	21
<b>Northampton</b>	1559	65	132	15	57
<b>Orange</b>	868	53	123	66	129
<b>Person</b>	919	23	84	9	13
<b>Rowan</b>	423	9	72	63	94
<b>Rutherford</b>	527	13	43	11	32
<b>Swain</b>	725	51	277	19	62
<b>Transylvania</b>	623	81	280	3	4
<b>Vance</b>	691	22	55	8	17
<b>Warren</b>	1844	71	148	49	299
<b>Wilkes</b>	689	13	64	4	4
<i>Grand Total</i>	<b>27567</b>	<b>1183</b>	<b>4489</b>	<b>1054</b>	<b>2305</b>

### European Gypsy Moth Program

#### **2013 Gypsy Moth Slow the Spread and Eradication Program**

In 2013 the North Carolina Department of Agriculture and Consumer Services' Plant Industry Division carried out an extensive survey, treatment, and regulatory program for Gypsy Moth. The program was divided into two separate areas, Slow the Spread (STS) and Eradication. The 2013 Project Boundaries are shown in Figure 23.

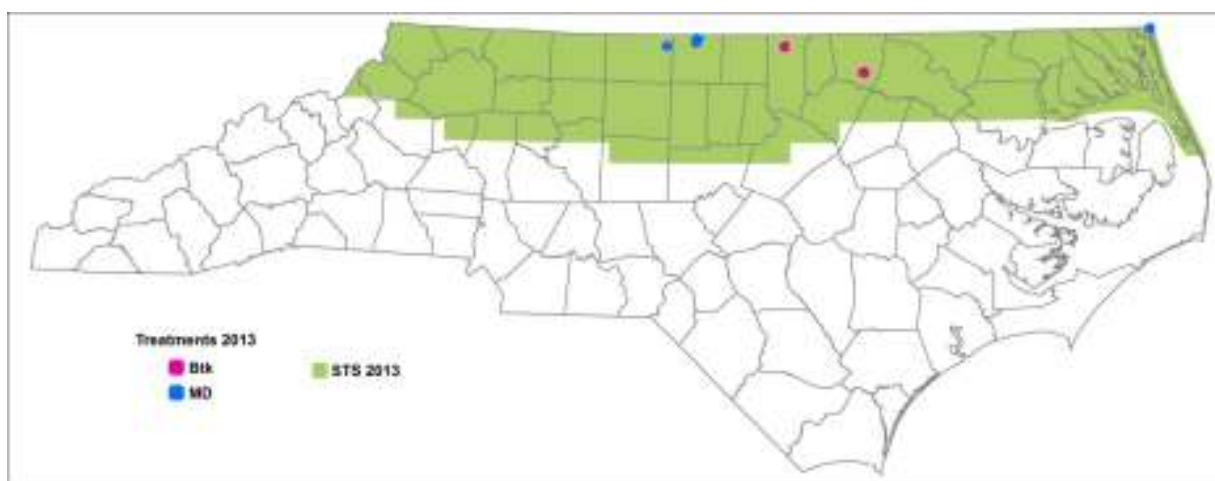


**Figure 23** 2013 Gypsy Moth Slow the Spread and Eradication Boundaries

Trapping and treatment in the STS area was conducted by contractors through the Gypsy Moth Slow the Spread Foundation, with NCDA&CS Plant Industry Division personnel providing quality assurance. The Plant Industry Division Gypsy Moth Program Manager provided program oversight and the Plant Industry Division STS Information Processing Technician handled the data and logistics. Numerous NCDA&CS Plant Industry Division personnel, both permanent and temporary, conducted surveys and treatments in the Eradication zone.

### 2013 Gypsy Moth Treatments

A modest increase in moth captures in 2012 resulted in a small but significant treatment program in 2013 (Figure 24). The 2013 gypsy moth treatment program treated 5,502 acres with either two applications of Btk (2,761 acres) or one application of Mating Disruption (2,741 acres).



**Figure 24** 2013 Gypsy Moth Treatment Blocks

In keeping with NEPA regulations, one mailing was sent out informing landowners of the proposed treatments and inviting them to attend a public meeting. Five public meetings were held, one in each county hosting a treatment, and a total of fifty-five people attended meetings. A second reminder mailing was sent approximately three weeks prior to the treatments.

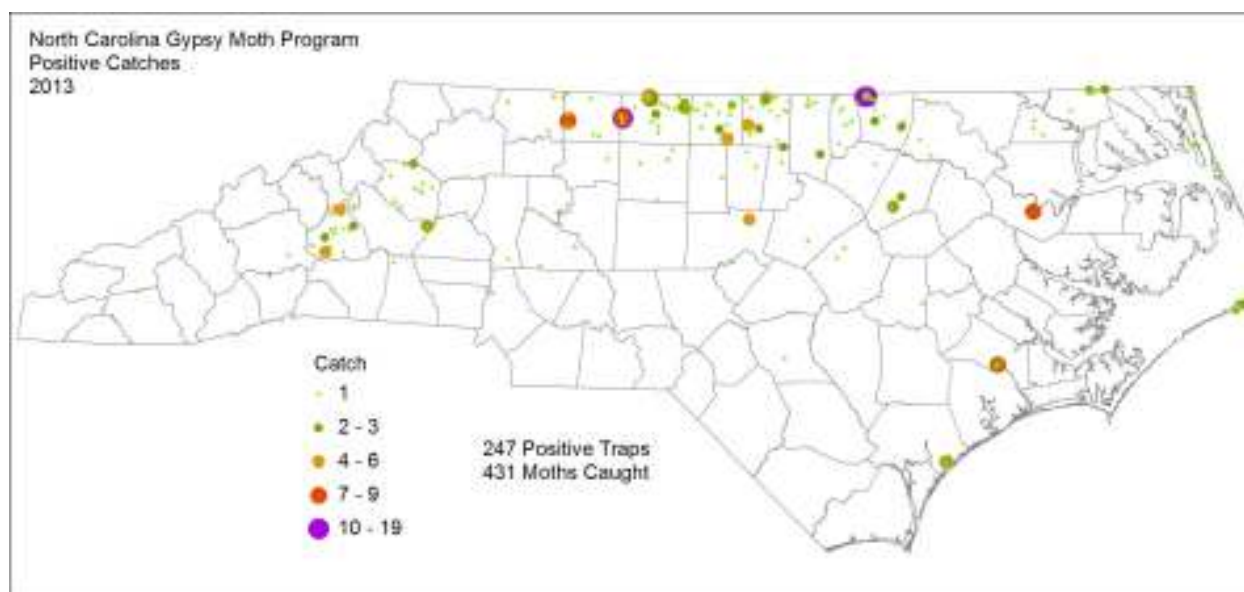
In collaboration with the USDA Forest Service, an Environmental Assessment (EA) was composed. A Finding of No Significant Impact (FONSI) was obtained in late March. No National Pollutant Discharge Elimination System (NPDES) permit was required as North Carolina's minimum annual treatment area threshold exceeded the treatment acreage. A request for exemption from North Carolina regulations prohibiting the application of pesticides over and near dwellings was applied for and granted from the NCDA&CS Structural Pests and Pesticides Division. Correspondence and data were submitted in support of the Btk and Mating Disruption contractors' pursuit of a Congested Area waiver from the Federal Aviation Administration.

The program maintained a proactive stance on public notification so that all members of the public had the opportunity to remain informed of program activities before, during, and after treatments. An email listserve and Twitter were utilized, in addition to the more customary mailings, phone calls, and personal contact. As a result, the number of complaints received during the course of the project was maintained at a very low level.

The two Btk blocks were treated by Helicopter Applicators at a cost of \$32.25 per acre per application. Evaluation of 2013 trapping data indicates that there were no significant male gypsy moth captures in these treatment blocks. Site evaluation in the Btk treatment blocks will continue in 2014. The US Forest Service held the contract for Mating Disruption throughout the STS project. AI's Aerial Spraying treated the three Mating Disruption blocks in North Carolina. The Mating Disruption blocks will be evaluated in 2014.

### 2013 Gypsy Moth Survey Data

Trapping results for 2013 yielded 431 male gypsy moths caught in 247 positive traps, as shown in Figure 25 below. Data was analyzed for potential treatment in 2014 by Plant Industry Division Entomologist Dr. Alonso Suazo, aided by Plant Industry Division Information Processing Technician John Kidd and USDA Forest Service personnel.



**Figure 25** 2013 Male Gypsy Moth Trap Catch Data

### 2013 Gypsy Moth Regulatory Program

The gypsy moth program also seeks to mitigate the risk of introduction through a comprehensive regulatory program. An area that is generally infested is quarantined such that the movement of certain high-risk articles is strategically restricted and regulated. In North Carolina, Currituck and a small portion of Dare Counties were quarantined in 1988. A map of the North Carolina gypsy moth quarantine area is shown in Figure 26.

Regulated articles may be moved from quarantined to non-quarantined areas if the appropriate personnel undergo training and submit to the stipulations of a compliance agreement with NCDA&CS. These compliance agreements require inspection and/or treatment of articles to ensure that they are free of gypsy moth life stages.



**Figure 26** NC Gypsy Moth Quarantine

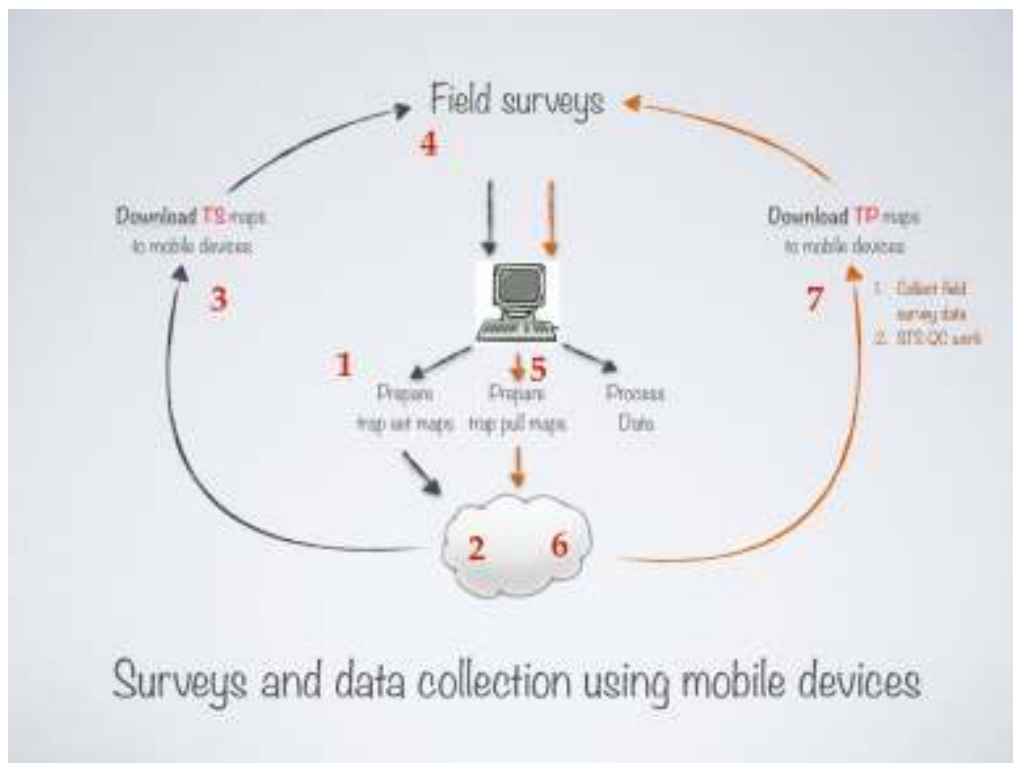
Public education efforts are also an important part of the regulatory program. Staff visits NC Cooperative Extension and NC Forest Service offices to update county personnel on program changes. Also, program personnel monitor all high-risk locations in the STS program area by the placement and removal of traps.

2012-2013 saw a modest amelioration of the past years' sustained downward economic trends. A handful of businesses requested training as they had recently hired additional staff. Also, several new Compliance Agreements were issued.

The regulatory program is currently in a time of transition as USDA-APHIS-PPQ, the federal granting agency, has steadily decreased gypsy moth regulatory grants. As a result, a dedicated NCDA&CS regulatory position no longer exists, though this staff member has assumed different responsibilities and remains available to assist with gypsy moth regulatory tasks. The future character of the program will be determined in part by USDA-APHIS-PPQ funding for this program.

### **Mobile Technology Platform to Improve Survey Efficiency**

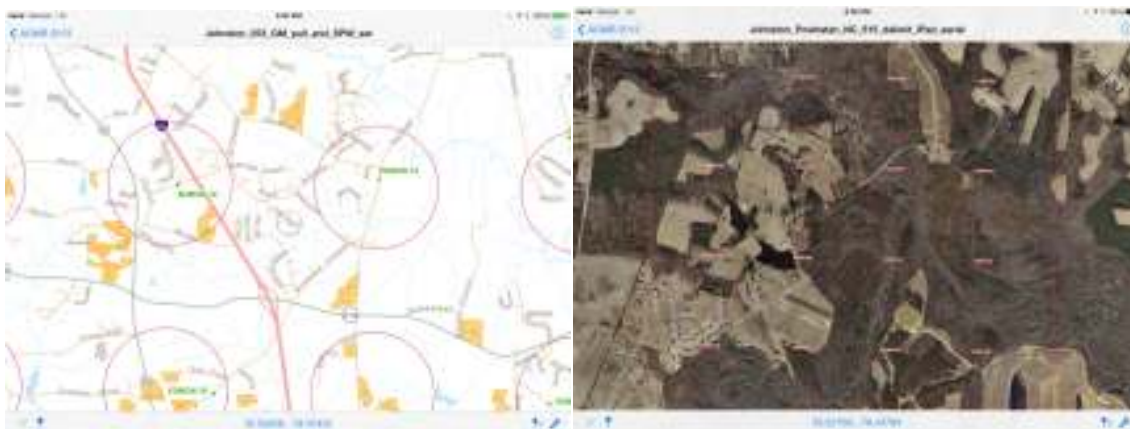
In 2013, Plant Industry Division staff tested a survey system using custom made geo-referenced pdf maps (GeoPdf) in mobile platforms (iPads) to navigate, set and pull traps and collect data as an alternative to our previous systems using hardcopy maps and Garmin navigation units. GeoPdf maps are extremely valuable because they can be used to navigate without the need of internet, cell phone and/or cellular connection. Pdf maps highly saturated with coordinates, referred to as GeoPdf maps, are used with the internal GPS system of iPads to determine the actual position (in coordinates) of the unit and locate in the GeoPdf map the corresponding coordinates, placing a blue dot in the map where the coordinate set of the map matches the corresponding coordinates as determined by the internal GPS reading of the unit. This position is updated on a regular basis and changes as the unit is moved from one location to the next, allowing for effective navigation. The iPad platform is ideal because it provides a high screen resolution; it is easy to use, reliable and allows us to work on multiple programs at the same time. The PdfMaps app (AVENZA®) provides the ideal platform to use this system. GeoPdf maps are placed in a cloud network (internal network or Dropbox), downloaded, and the data is collected using the PdfMaps app (Figure 27).



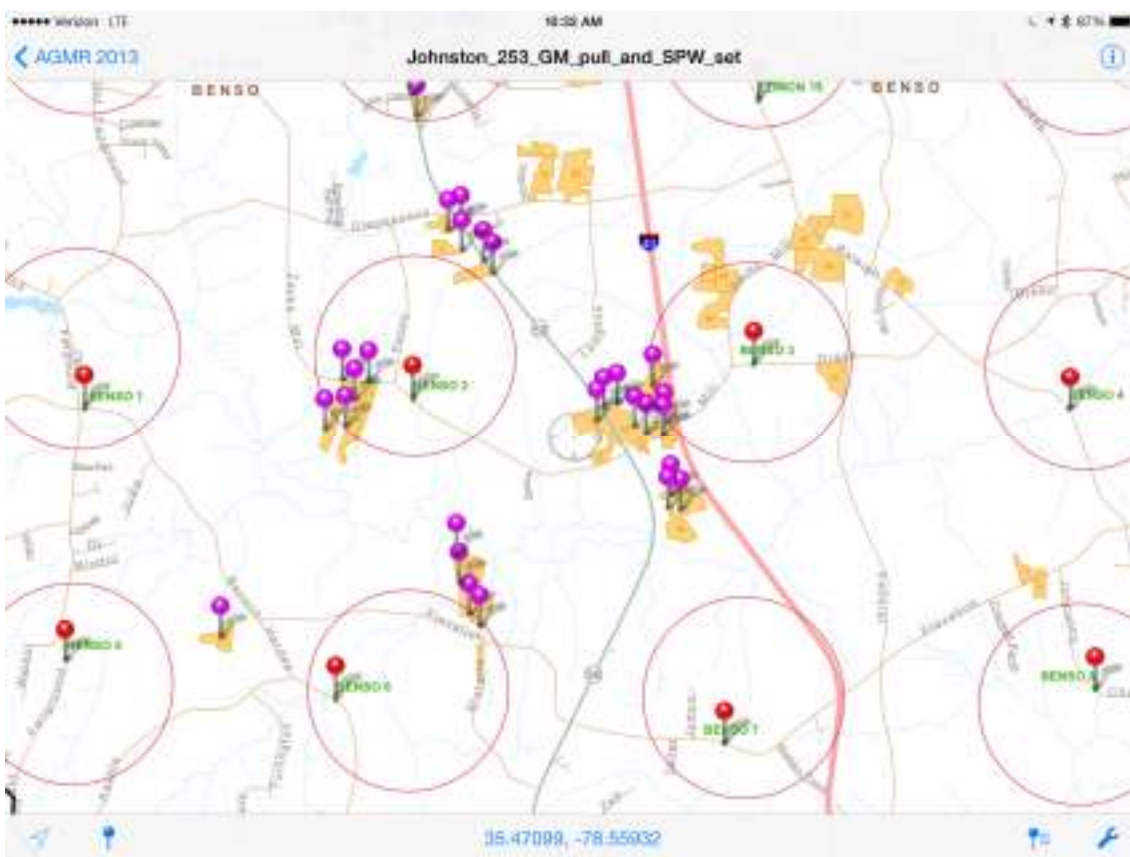
**Figure 27** Diagram showing the survey process using mobile technologies with GeoPdf files.

Custom made GeoPdf maps are prepared (1) and placed in a cloud network (2) for easy accessibility by trappers. Maps are downloaded (3) into mobile devices (iPad mini Apple inc.) and used to navigate, locate trap sites and set traps in the field (4). Trap set (TS) information, including coordinates, is stored in the mobile devices and transmitted to our GIS specialist (5), who in turn uses that information to generate new sets of maps for trap pull (TP) operations. Trap pull maps are placed in the cloud network (6), downloaded by our field personnel (7) and used to pull traps at the end of the season. These maps are also used in numerous programs for quality control. Trap pull information is relayed back to the GIS specialist for analysis.

This system has proven very valuable, cost effective and efficient, resulting in better data quality, improved field productivity and cost savings to our survey programs. Custom made maps that include information on multiple programs can also be generated and used for multiple surveys simultaneously (Figure 28 and Figure 29) substantially saving money in gas and time spent in the field. Other applications using this technology will be further tested in the future.



**Figure 28** Examples of custom made GeoPdf maps including road maps (**left**) and aerial maps (**right**). Maps show the target areas to set the traps (circles) and/or the location where a trap has been set (green dot with label).

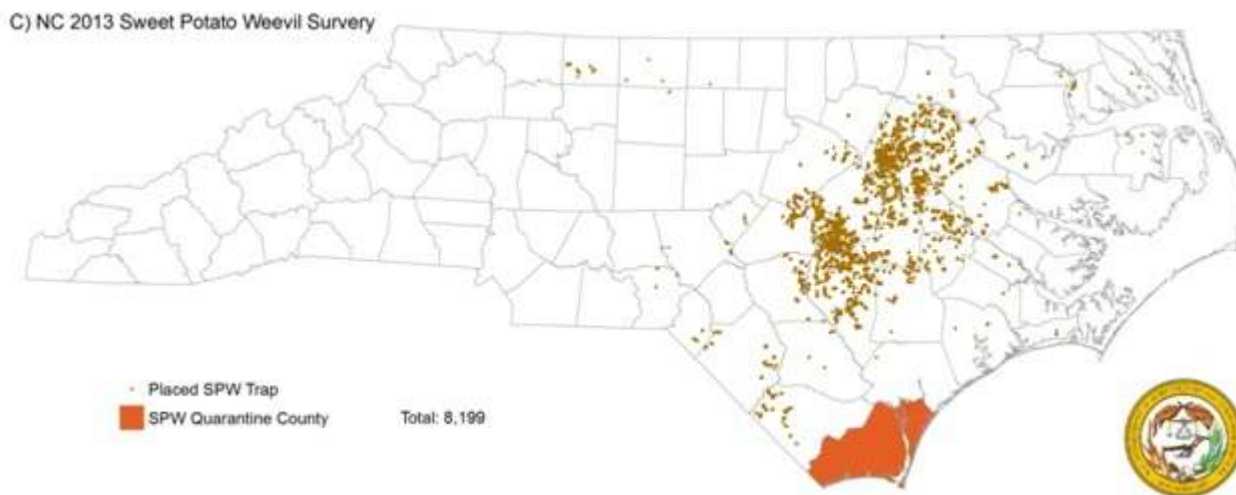


**Figure 29** Combined map for gypsy moth and sweet potato weevil surveys. Gypsy moth traps (red pushpins) and sweet potato weevil traps (purple pushpins) in target circles (gypsy moth) and fields (sweet potato weevil).



### **Sweet Potato Weevil Program.**

North Carolina continues to lead the nation in sweet potato production, with 46.8% of all U.S. production in 2012 (USDA NASS). The sweet potato weevil (*Cylas formicarius* L.) is the most damaging pest of sweet potatoes in the world. With an increasing demand for North Carolina sweet potatoes, the increase in movement of sweet potatoes to North Carolina from regulated areas in the southeastern United States and the construction of new sweet potato processing plants in the state, the risks of introduction and establishment of the sweet potato weevil has never been greater. Sweet potato weevils can significantly affect the North Carolina sweet potato industry by reducing the yield of affected fields, damaging the quality of the infested sweet potatoes, increasing the production cost for sweet potato farmers and imposing new restrictions on the movement of North Carolina sweet potatoes to other states and overseas. Our mission at the NCDA&CS Plant Industry Division is to implement effective programs to reduce the risk of accidental and/or unintentional introduction of sweet potato weevils in North Carolina sweet potato production areas and to eradicate any weevil populations that may be introduced into the state. Early detection and rapid response (EDRR) of weevil introduction is critical for a successful eradication program. Our most important tools for EDRR are surveys. Throughout the state, surveys are conducted using traps baited with pheromone lures that attract male sweet potato weevils. Surveys are conducted on a yearly basis in the sweet potato production areas in fields and storage and processing facilities, in research facilities, greenhouses in nursery operations, and in the North Carolina quarantined area in Brunswick and New Hanover counties (Figure 30).



**Figure 30** Areas in NC surveyed for sweet potato weevil (*Cylas formicarius*). Quarantined area shown in orange.

NCDA&CS also provides certification cards to producers/packers to facilitate the movement of North Carolina sweet potatoes to other areas in the nation and overseas that require documentation to certify these commodities are produced in a sweet potato weevil-free area.

## Field Surveys.

Field surveys were conducted from mid August to mid October 2013 in 43 counties, primarily in Eastern North Carolina. The USDA Farm Service Agency reported 56,555.6 planted acres

Table 9). Traps were set according to the guidelines and protocols established by the Southern Plant Board in 1995. Briefly, two traps are placed for the first 10 acres, with 1 additional trap for each additional 10 acres with a minimum of 2 traps per field. Conventional green boll weevil traps were used for sweet potato weevil surveys in production fields (Figure 31) because of their low cost. Custom made GeoPdf maps were used in mobile devices (iPad minis) to navigate and locate sweet potato fields and to collect data including time and date of trap set, field type (reported, unreported and absent) and coordinates (latitude and longitude) for each trap set. A total of 8,036 traps were set of which 7,205 (89.6%) were recovered in good condition during the trap pull period. Traps were left in the field for a period of three weeks and subsequently pulled. Data collected during the trap pull process include the trap condition (i.e. damaged, good, lost) (Table 10) and the number of weevils found. **No sweet potato weevils were found in field surveys during this period.**

**Table 9** 2013 reported sweet potato acres and fields in North Carolina counties.

County	Fields	Acres	County	Fields	Acres
Beaufort	2	22.2	Lenoir	129	1775.5
Bladen	3	98.2	Martin	8	101.6
Carteret	3	59.1	Montgomery	1	32.0
Chowan	14	180.8	Moore	13	85.6
Clay	1	23.9	Nash	911	7966.5
Columbus	65	626.0	Northampton	1	19.5
Craven	4	37.2	Onslow	3	18.1
Cumberland	78	1251.3	Pasquotank	1	10.0
Davidson	1	3.2	Pitt	127	1352.5
Duplin	80	1363.8	Polk	1	13.4
Edgecombe	530	6370.5	Richmond	5	95.0
Forsyth	2	20.7	Robeson	112	1700.7
Franklin	11	67.9	Rockingham	3	12.4
Greene	75	1007.7	Sampson	690	8985.0
Guilford	1	10.2	Scotland	9	407.1
Halifax	39	497.0	Stokes	22	92.1
Harnett	180	1560.0	Tyrell	3	36.7
Hertford	1	2.6	Wake	118	796.2
Johnston	1089	9608.4	Warren	1	4.3
Jones	1	60.0	Wayne	311	3483.7
Lee	7	35.4	Wilson	753	6661.6

**Table 10** Sweet potato weevil field surveys. Trap pull data summary.

County	Damaged	Good	Lost	Total
Beaufort		2		2
Camden		1		1
Carteret		6		6
Chowan		36		36
Columbus	1	127	11	139
Craven		6	1	7
Cumberland	1	125	11	137
Duplin	19	184		203
Edgecombe	23	727	22	772
Franklin		15		15
Greene	9	284	33	326
Guilford		2		2
Harnett	1	221	3	225
Hertford		3		3
Johnston	42	1259	124	1425
Jones		3		3
Lee		10		10
Lenoir	2	168	11	181
Montgomery		3		3
Moore		18		18
Nash	52	1054	118	1224
Pasquotank			2	2
Pitt	1	167	2	170
Richmond		13		13
Robeson	4	154	10	168
Rockingham		2		2
Sampson	14	1102	152	1268
Scotland	1	29	11	41
Stokes		23	1	24
Tyrrell		5		5
Wake	1	146	4	151
Wayne	14	453	81	548
Wilson	31	857	28	916
<b>Totals</b>	216 (2.7%)	7205 (89.5%)	625 (7.8%)	8046

## Storage Facility Surveys

Sweet potato storage facilities, processing plants, micropropagation units and greenhouse operations growing ornamental sweet potatoes were surveyed continuously throughout the year. Because of the higher trapping efficiency, Universal Moth Traps or bucket traps were used instead of the conventional green boll weevil traps used in the field (Figure 31). For these operations, a minimum of two (one inside and one outside) and a maximum of four traps were set per operation. Traps were placed in major strategic locations where sweet potatoes are stored and/or in and around the locations outside the buildings where sweet potatoes are loaded or unloaded. Lures were changed in each trap once a month and data collection was done using the same procedure detailed for the field surveys. A total of 73 storage facilities were surveyed in 17 counties (Table 11). **No sweet potato weevils were found at these facilities in 2013.**

**Table 11** Storage facilities surveyed for sweet potato weevil in NC in 2013.

County	Number of storage facilities	County	Number of storage facilities
Chowan	3	Pender	1
Columbus	5	Pitt	1
Edgecombe	2	Sampson	11
Greene	2	Robeson	1
Harnett	2	Union	1
Johnston	13	Wake	2 (micropropagation NCSU)
Lenoir	3	Wayne	2
Mecklenburg	1 (Ornamental sweet potato)	Wilson	8
Nash	15		



**Figure 31** Sweet potato weevil traps

Green boll weevil trap used to survey sweet potato fields (**left**) and a Universal Moth Trap used to survey storage facilities (**right**).

## **Quarantined Area Surveys**

Surveys for sweet potato weevil were conducted in the quarantined areas in New Hanover and Brunswick counties from July to December. Approximately 100 traps were set along two transects in Carolina and Caswell beach to monitor weevil populations. Lures were changed every month and data on weevil numbers and positive trap locations was recorded. Sweet potato weevils are still detected in the area with peak numbers in August and September.

## **Emerald Ash Borer Program**

The emerald ash borer (*Agrilus planipennis*) (EAB) is a serious pest of forest trees affecting primarily trees of the genus *Fraxinus* (ash trees). It was first detected in 2002 in the United States and is believed to have been introduced in wood packaging material from China. Since it was first detected, EAB has spread throughout most of the eastern United States. Although their natural spread is limited to an average of 5 miles per year, EAB's rapid spread is attributed to the interstate movement of infested material such as firewood. Prior to 2013, no EAB had been reported in North Carolina. However, recent findings in both Tennessee and Virginia near the North Carolina border suggested a high risk of EAB being present in North Carolina. Our previous survey work had focused on drive-by surveys and a limited number of purple prism traps conventionally used to survey EAB in these state border areas. As part of the national EAB survey program, North Carolina conducted a statewide survey in 2013. The main purpose of this survey was to determine whether new pockets of EAB infestation exist from the already established distribution line and to determine the extent of any EAB distribution in North Carolina.

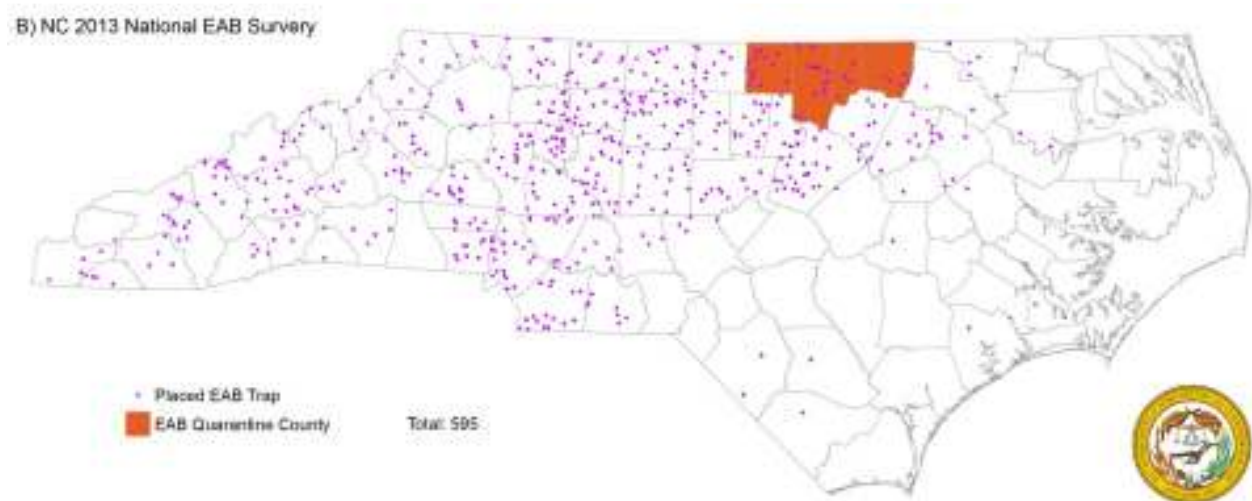
## **Methodology and Results**

In the early phase of the 2013 EAB survey season, the NCDA&CS-Plant Industry Division hired four temporary employees to scout for ash trees in the North Carolina Piedmont and Coastal areas, using as a reference maps indicating the locations of potential ash trees (target sites). These maps were provided by USDA-APHIS-PPQ personnel coordinating the EAB national program and were based on the survey sampling design model developed by USDA-APHIS-PPQ and the Forest Health Technology Enterprise Team also referred to as the FHTET model. Ash tree scouting was done for one month prior to the start of the trap set date with the intention of facilitating and speeding the trap set process in areas of North Carolina where ash trees are less common.

Trap set, check and pull was done according to the established USDA-APHIS-PPQ 2013 survey guidelines. Briefly, purple prism traps baited with a lure consisting of a mix of Manuka oil and Z-3 Hexanal were placed exclusively in ash trees at a minimum height of 15 feet. Traps were checked and the lure changed after 6-8 weeks and were completely pulled and inspected for EAB presence at the end of the survey season (July for Eastern NC and August for Western NC). Trap set calendars were established based on the 450 degree day line for the state of North Carolina. Trap locations was recorded using mobile GPS units.

For the 2013 EAB survey season, personnel from the Plant Industry Division (including 8 temporary employees) and the NC Forest Service set up 593 traps in 73 counties across North Carolina (Table 12 and Figure 32). As a result of these surveys, two EAB adults were found in traps in Person and Vance counties (Figure 33) and the first reported EAB in the state was found in Granville County in visual surveys of declining ash trees. Adult EAB were sent to Dr. James Zablotny, USDA Maryland, APHIS-

PPQ for official identification and confirmation. Data collected in those sites were entered into NAPIS as the official first report for the state of North Carolina. A subsequent finding of EAB in Warren County resulted in a total of four counties (Vance, Person, Granville and Warren) being officially placed in state and federal quarantine.



**Figure 32** Emerald ash borer traps set in North Carolina for the 2013 survey season.

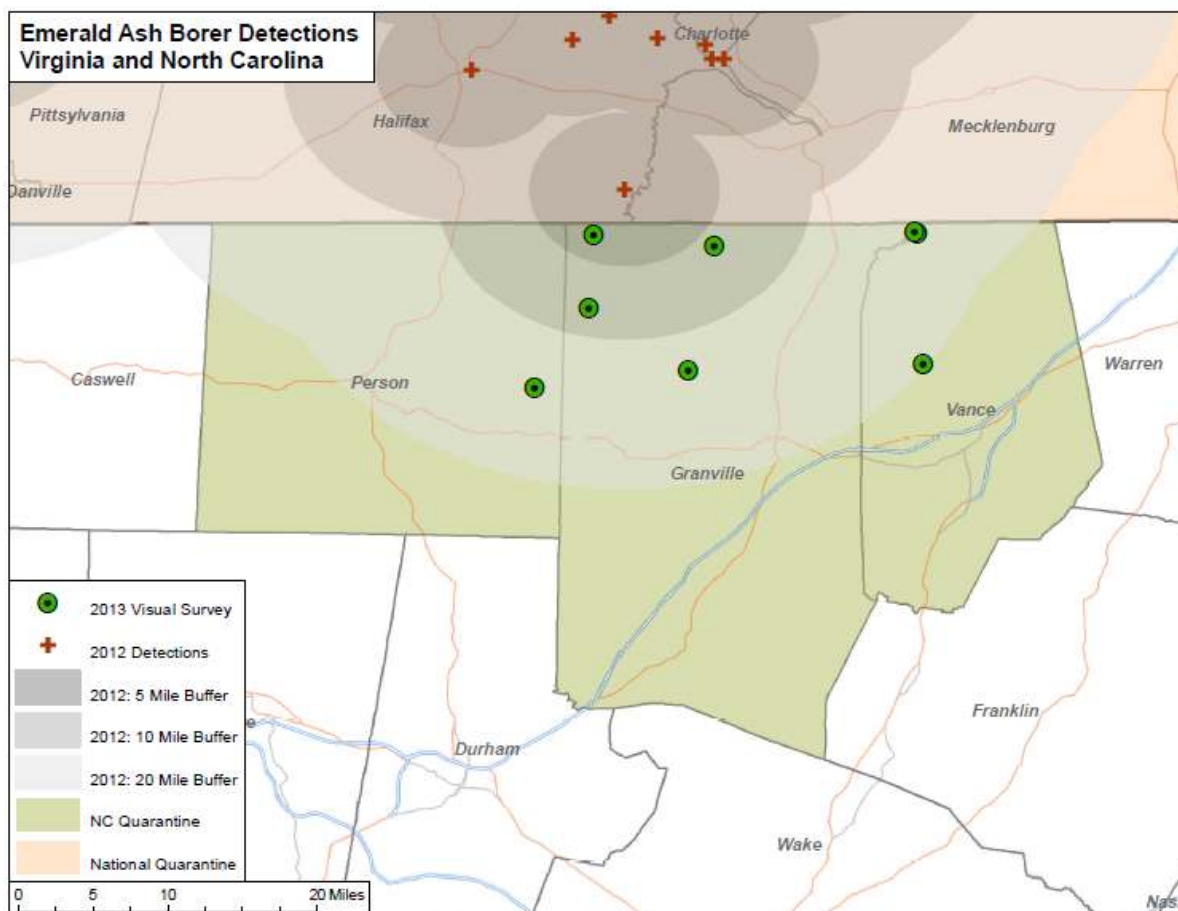
Red areas indicate the sites where the first EAB adults were reported in purple prism traps set in NC and in visual surveys. Quarantined counties are Vance, Person, Granville and Warren.

**Table 12** Distribution of EAB traps set in NC counties.

County	Traps Set	County	Traps Set	County	Traps Set
Alamance	11	Franklin	11	Person	16 (1 positive)
Alexander	2	Gaston	10	Pitt	1
Alleghany	4	Graham	1	Polk	2
Anson	7	Granville	17	Randolph	16
Ashe	4	Guilford	26	Robeson	2
Avery	4	Halifax	2	Rockingham	16
Bertie	2	Haywood	18	Rowan	20
Bladen	1	Henderson	4	Rutherford	5
Buncombe	15	Hertford	1	Stanly	6
Burke	7	Iredell	18	Stokes	13
Cabarrus	12	Jackson	7	Surry	14
Caldwell	9	Johnston	2	Swain	5
Carteret	4	Lincoln	7	Transylvania	4
Caswell	10	Macon	4	Union	17
Catawba	12	Madison	9	Vance	5 (1 positive)
Chatham	12	McDowell	5	Wake	25
Cherokee	4	Mecklenburg	19	Warren	6
Clay	4	Mitchell	4	Watauga	4
Columbus	1	Montgomery	4	Wayne	1



Craven	3	Moore	4	Wilkes	5
Davidson	18	Nash	11	Wilson	2
Davie	13	Northampton	6	Yadkin	9
Durham	8	Onslow	2	Yancey	3
Edgecombe	4	Orange	14	<b>Total</b>	<b>593</b>
Forsyth	18	Pasquotank	1		



**Figure 33** Location of first EAB findings in NC.

### **Walnut Twig Beetle Program (Thousands Cankers Disease of walnuts)**

Thousand cankers disease (TCD) is a serious disease of forest trees affecting primarily black walnuts (*Juglans nigra*) and butternuts (*Juglans cinerea*). The disease is characterized by a large number of “cankers” (dead tissues) on branches and stems causing dieback and, in severe cases, tree mortality. TCD is spreading rapidly through the Eastern United States and has been reported in Virginia and Tennessee and more recently in Haywood County in North Carolina. As a result of TCD presence in Haywood County, the entire county was quarantined in January 2013 and the movement of firewood and other regulated commodities from that area is restricted. The Plant Industry Division, in collaboration with the North Carolina Forest Service, has been conducting TCD surveys along these border areas in North Carolina since 2011.

## **Nursery Certification Program**

NCDA&CS Plant Protection Specialists inspected 3,884 nursery dealers and nurseries during the 2013 season. Seven Stop Sale/Movement notices were issued to prevent the sale of infected or prohibited plants. These plants were either treated or destroyed.

The data show a slight decrease in the number of nurseries and the number of acres that were certified. This drop is believed to be a reflection of the downturn in the economy and its impact on the nursery industry. A slight increase was seen in the number of Nursery Dealer Certificates issued (a gain of 175). Several chain stores have increased slightly which hopefully indicates an improving economy. Most of these chains stores carry stock at selected times during the year and hopefully they will be purchasing more product from production nurseries.

A license issued by the NCDA&CS is required by any person selling nursery stock in North Carolina. Nursery stock is defined as “all wild or cultivated plants or parts thereof, trees, shrubs, vines, bulbous plants and roots, grafts, scions and buds.” Excluded in North Carolina’s definition of nursery stock are “annual plants, cut flowers, tree, field, vegetable, flower or other true seeds; decorative plants or plant parts without roots not intended for propagation; and perennial plants intended for indoor use that are produced in North Carolina.” A *nursery license* is required for any person growing and selling nursery stock whereas a *nursery dealer license* is required for any person obtaining and re-selling nursery stock. These licenses certify that plant material has been inspected for and is apparently free from potentially harmful quarantine pests and must be renewed yearly.

The NCDA&CS Plant Protection Section licensed 1,063 nurseries and 2,821 nursery dealers during the 2013 calendar year (Table 13). Of the 1,063 nurseries, 515 were registered nurseries and 548 were certified nurseries. A *registered nursery* has less than one acre of nursery stock and does not sell outside the state. A *certified nursery* has one or more acres of nursery stock and/or sells outside the state.

**Table 13** Number of NC nursery and nursery dealer licenses by year<sup>w</sup>

Calendar Year	Number of Licenses by Category			Total Number of Licenses	
	Registered Nursery <sup>x</sup>	Certified Nursery <sup>y</sup>	Nursery Dealer <sup>z</sup>	Nurseries (Registered & Certified)	Nurseries & Dealers
2011/2012	611	693	2,646	1,304	3,950
2013	515	548	2,821	1,063	3,884

<sup>w</sup>Data based on receipt of license fees.

<sup>x</sup>Registered nursery – a location with less than once acre of nursery stock with no sales outside the state.

<sup>y</sup>Certified nursery – a location with one or more acre of nursery stock and/or sales outside the state.

<sup>z</sup>Nursery dealer – a location where nursery stock is sold, usually to the end user, but not actually grown.

The primary objective of Plant Industry’s Nursery Program is to facilitate the movement of nursery stock while preventing the introduction and spread of quarantine plant pests into and within North Carolina. The movement of infested nursery stock represents one of the ways plant pests may be moved from one location to another and has the potential to directly impact both wholesale and retail nursery operations. Given the potential threat of introduced plant pests, including diseases, insects and weeds into North Carolina, along with the potentially devastating impact this threat could pose on North

Carolina's nursery industry, a web-based application, *NCPlants*, has been developed. Nurseries and nursery dealers enter all plant acquisition sources into *NCPlants* to provide an electronic database to help track and isolate source(s) of a pest outbreak should it occur. Prior to this initiative, this information had only been maintained in hardcopy format and as such not readily useable in the event of a pest outbreak thus extending the time to identify the source(s) and isolate the problem. Effective with the 2012-13 nursery certification period, NCDA&CS requires all nurseries to record plant acquisition information in *NCPlants* as part of the licensing process. This requirement was initiated for nursery dealers for the 2011-2012 certification period. Information in *NCPlants* will only be available to NCDA&CS personnel and will assist staff in more effectively tracking nursery plant material from in-state and out-of-state sources in the event of a significant pest outbreak.

Stop sale/movement notices are issued when high levels of pests and/or prohibited plants are noted. Plants can either be treated and/or destroyed when a stop sale/movement notice is issued. During calendar year 2013, seven stop sale/movement notices were issued.

## **Export Certification Program**

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Within the Export Certification Program, Plant Protection Specialists issue phytosanitary certificates to growers and/or brokers to facilitate movement of agricultural commodities to other states and to other countries. Phytosanitary certificates indicate that inspections and other specific requirements of the importing states or countries have been met. State certificates are used for movement within the U.S., and federal certificates are required for movement to another country. Countries and states vary greatly in what they require for various types of commodities such that careful research and interpretation of requirements are needed for each request for phytosanitary certification. Primary use of the USDA Phytosanitary Certificate Issuance and Tracking System (PCIT) to issue federal certificates began in October 2009. Federal certificates were issued for the movement of commodities to 92 countries, while state certificates were issued for 23 states and Puerto Rico. The majority of phytosanitary certificates issued were for lumber, tobacco, cotton, cotton seed, Christmas trees, peanuts, nursery and greenhouse plants, sweet potatoes, and sweet potato cuttings.

A phytosanitary certificate provides documentation that a plant, plant part, or plant-based product has been inspected and is apparently free of harmful pests. Each state and country has very specific import phytosanitary requirements that are tailored to protect their agricultural industries and natural environment from potentially harmful pests.

The NCDA&CS Plant Protection and Export Certification Specialists facilitate interstate and international movement of plants, plant parts, and plant-based products by issuing both state and federal phytosanitary certificates to North Carolina growers and brokers. State and federal phytosanitary certificates are issued for interstate and international movement, respectively. The NCDA&CS is responsible for implementing the state export program while USDA is responsible for implementing the federal export program. However, NCDA&CS works in collaboration with USDA to issue federal phytosanitary certificates to support international export of plant-based products from North Carolina.

The USDA PCIT system has been used to issue both federal and state phytosanitary certificates by NCDA&CS since October 2009. The number of federal and state phytosanitary certificates issued using the PCIT system is included in Table 14. NCDA&CS staff issued 6,658 federal phytosanitary certificates and 412 state phytosanitary certificates in calendar year 2013. The number of federal phytosanitary certificates issued in 2013 was 36% greater than issued in 2011/2012. In 2013, the Plant Industry Division collected a total of \$574,905 in fees for issuing federal phytosanitary certificates. NCDA&CS does not charge for issuing phytosanitary certificates required for interstate movement.

**Table 14** Number of phytosanitary certificates issued through the PCIT<sup>z</sup> system

<b>Fiscal Year</b>	<b>Federal</b>			<b>State</b>	
	<b>Plant or Plant Part</b>	<b>Re-export</b>	<b>Processed Plant Product</b>	<b>Total</b>	<b>Total</b>
2009/2010 <sup>y</sup>	1759	24	0	1783	205
2010/2011	2781	21	0	2808	323
2011/2012	4221	13	18	4252	206
2013 (Calendar Year)	5,830	15	134	6,658	412

<sup>z</sup> PCIT = Phytosanitary Certificate Issuance and Tracking (USDA web based application)

<sup>y</sup> Use of PCIT began in October 2009

## **Plant Conservation Program**

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### **North Carolina Plant Conservation Board**

The Plant Conservation Program (PCP) meets quarterly with members of the NC Plant Conservation Board whose seven members are appointed by the Governor and the Commissioner of Agriculture. Changes to the board's composition include Hollis Wild stepping down from the board and David Hyatt accepting an invitation to replace her. David Hyatt will represent the commercial plant production industry. Jon Lanier of NCDA&CS Legal Affairs replaced David McCleod who retired from the Department. Mark Rose's term has expired and an announcement regarding his replacement is expected in the near future.

### **North Carolina Plant Conservation Scientific Committee**

The Program continues to meet regularly with members of the NC Plant Conservation Scientific Committee. This seven-member committee consists primarily of positions designated to the committee by law. More recently, the Committee has begun to focus on commercially traded plants.

The Committee recommended a buying season for Galax, a broadleaf evergreen groundcover used in floral arrangements. The season (July 1st through March 31<sup>st</sup>) allows the plant to flower and seed. The Committee has also provided input on Venus flytrap regulation, an exploited species plant list, and PCP's strategic plan.

### **North Carolina Plant Conservation Program Staff**

The Plant Conservation Program has three State-funded staff: Nancy Stewart, Information Processing Tech, Rob Evans, Ecologist, and David Welch, Administrator. United States Fish and Wildlife Service Section 6 Cooperative Grant for Federally-listed plant species funds Research Specialist, Lesley Starke. A variety of grants support field technician work on preserves.



### **Plant Conservation Preserve System**

The Plant Conservation Program and Board have the regulatory authority to establish Plant Conservation Preserves to protect imperiled plant species. These Preserves are the only state-managed lands selected and designed specifically for plant conservation purposes. The Preserve system currently consists of 23 Preserves distributed across North Carolina (Figure 34). In 2013, PCP added more than 700 acres and two new preserves with the addition of Redlair Farm and Forest and Rocky River/Morgan Bluff. The Corbett/Young tracts augmented Boiling Spring Lakes Preserve. These additions were made possible with grant funds received from state and federal sources, as well as significant matching funds from private donors.



**Figure 34** Plant Conservation Preserves, 2013.

### **Preserve Field Trips**

Although Preserves are not generally open to the public due to concerns about poaching, a number of field trips were lead by Plant Conservation staff and partners to selected sites. Preserve tours for members of the public were conducted at Cedar Mountain Bog, Eno Diabase Sill, Hog Branch Ponds, Hebron Road, Redlair Farm and Forest, as well as several partnership sites.

### **Plant Conservation Preserve Management & Monitoring Activities**

PCP has continued efforts to restore and maintain critical habitats for over 65 imperiled plant species populations found across the Plant Conservation Preserve system. A large number of these species require open conditions maintained by frequent fire. Prescribed fire, also known as controlled burning, is one of the most important management activities conducted on Plant Conservation Preserves.

## **Prescribed Fire**

In 2013, at least 11 prescribed fires were conducted on Preserves; 9 of which were conducted directly by PCP staff. Prior to each prescribed fire, staff conducts extensive planning and preparation at each site following North Carolina smoke management guidelines and additional procedures developed by the NC Forest Service.

## **Mechanical Habitat Improvements**

Many of the sites under management by PCP have become dense and overgrown after decades of fire suppression prior to our efforts to reintroduce prescribed fire. Some of these sites cannot be restored with fire alone. In these cases, mechanical means of brush clearing and removal are used to re-open the habitat for the benefit of species such as Smooth Coneflower (*Echinacea laevigata*). Extensive brush clearing and tree removal was conducted at the Hebron Road and Eno Diabase Plant Conservation Preserve, as well as an important partnership site known as the Blue Indigo Slope Nature Preserve (owned by the Eno River Association).

At the Hebron Road Preserve, mechanical thinning has been very nearly completed across an approximately five acre core area in and around a target population of *Echinacea*. This effort directly complements population augmentation efforts for the species. Newly thinned habitat resulted in increased flowering and seed production as well as creating suitable donor sites to receive 29 new seedlings grown from seeds collected on site.

At the Eno Diabase Preserve similar work was conducted at the home to the largest locally occurring subpopulation of *Echinacea laevigata*. After extensive felling of loblolly pines by chainsaw trained PCP staff, several volunteer workdays were initiated to remove these cut stems from the interior of the site. PCP procured the service of two large NCDOT dump trucks and removed seven truck loads of cut and downed materials.

At the Cedar Mountain Bog Preserve PCP staff was joined by NC Forest Service employees from Transylvania County and the Young Offenders Forest Conservation Program (also known as B.R.I.D.G.E.) to improve habitat for the federally endangered Mountain Sweet Pitcher Plant (*Sarracenia jonesii*). Extensive woody debris previously downed by staff was removed and chipped. The service of a rental dump truck and driver were provided by a small grant provided by the North American *Sarracenia* Conservancy. Before leaving the site, BRIDGE personnel were also able to help install several sections of fireline.

## **Invasive Plant Removal**

PCP staff treated several large infestations of Japanese stilt grass, *Microstegium vimineum*, in parts of the Eno Diabase Preserve, significantly reduced populations of privet (*Ligustrum sinense*, *Ligustrum japonicum*, Heavenly Bamboo (*Nandina domestica*) and stilt grass (*Microstegium vimineum*) across the Hebron Road Preserve. Staff and volunteers reduced *Sericea Lespedeza* infestations at the Harvest Field Preserve for the benefit of Schweintz's Sunflower, and helped Catawba Lands Conservancy and others reduce Autumn Olive stems at the Redlair Preserve.

## Seed Collection & Augmentation Of Smooth Coneflower

PCP staff worked closely with volunteer Plant Conservation Preserve Stewards who worked under special permits and collectively volunteered over 300 hours across Durham area Plant Conservation Preserves. A majority of this time was spent collecting and growing *E. laevigata* seeds for eventual outplanting. The stewards carefully collected, documented, and kept separate all seeds, traceable to each subpopulation. The stewards were able to add over 100 coneflower seedlings to 3 small, recovering populations significantly expanding them.

## Vegetation & Protected Plant Monitoring Projects

PCP staff continued population monitoring efforts for several species across North Carolina. As part of recovery efforts for these species we must be able to document that populations are stable or increasing:

- *Echinacea laevigata* (Smooth Coneflower) was monitored for the tenth consecutive year across seven sites, the largest of which has in excess of 43,000 flowering individuals.
- *Helianthus schweinitzii* (Schweinitz's Sunflower) at 3 existing Plant Conservation Preserves (in one case for the 8<sup>th</sup> consecutive year), as well as the second consecutive year at the recently acquired Redlair Plant Conservation Preserve.
- *Dionaea muscipula* (Venus Flytrap) for the fifth year at four sites in eastern North Carolina.
- *Sagittaria fasciculata* (Bunched Arrowhead) for the third consecutive year.

Baseline monitoring efforts were conducted for three additional species at all available sites statewide where they are found:

- *Shortia galacifolia* var. *galacifolia* (Northern Oconee Bells) was counted at nine of eleven previously reported sites; PCP staff discovered one new site and rediscovered a second. One of the two unvisited sites is thought to be extirpated.
- *Baptisia minor* var. *aberrans* (Wild Blue Indigo) in fifteen sites. PCP staff discovered one new site during surveys.
- *Lithospermum canescens* (Hoary Puccoon) was evaluated at eleven sites including two sites discovered by PCP Staff.

At the Eno Diabase Preserve, PCP previously installed two vegetation plots to help document the impact of the prescribed burns that have been conducted. The plots were initially inventoried in 2011 prior to two prescribed burns in 2011 and 2013. In May and June of 2013, PCP staff, with the help of volunteer stewards, re-inventoried one of the plots to determine the impact of the fire on herbaceous release and woody plant control.

At the Pondberry Bay Preserve, PCP collected data on the impact of a late 2012 prescribed fire on the wetland habitat for the federally endangered *Lindera melissifolia*. The fire was, perhaps, the first ever conducted for the species across its natural range and appears to have had beneficial effects. We have involved an NCSU student in preliminary data entry and analysis.

Staff and a collaborator from Tall Timbers Research Station are entering in the 5<sup>th</sup> year of an experimental management project related to *Lysimachia asperulifolia* (federally endangered). A

manuscript documenting results has gone through two revisions and may be ready for publication in a scientific journal soon.

Two PCP staff co-authored a chapter in a recently published book on the Venus Flytrap; the chapter focuses on the conservation status of the species in the wild.

### **Steward Activity**

Many of the management projects at the Durham Preserves have been enhanced with the reliable help from three volunteer stewards who travel from Wake County to participate in a variety of activities including, but not limited to, prescribed burning, trash pick-up, invasives control, seed plot establishment, seed collection, etc. Smooth coneflower seeds that were collected last summer were grown by Herb and Pat Amyx at their home for the purpose of reintroduction. Currently, it seems possible that these efforts could double the size of one of our smallest Smooth Coneflower subpopulations. Additional volunteer steward efforts include assistance with restoration activities on the Hebron Road, Harvest Field and Pondberry preserves including mostly clean-up of cut stems and other vegetation for thinning operations.

### **Natural Heritage Trust Fund Grants**

PCP has relied extensively on the Natural Heritage Trust Fund (NHTF) for preserve acquisition projects. Applications were submitted for consideration in the spring of 2013. The NHTF has recently merged with the Clean Water Management Trust Fund (CWMTF). PCP's submission for funding was for the 40 acre Caraway Tract in McDowell County; CWMTF approved funding for this project.

### **Site Acquisition Planning**

A systematic and comprehensive evaluation of site protection needs was updated this year. This "portfolio of Important Plant Conservation Areas" continues to guide our efforts in working with land owners and managers across the state to better protect these critical sites. PCP Staff has coordinated with NC Natural Heritage Program staff to add a new field in their database that tracks attributes of special importance to PCP acquisition efforts and planning. PCP staff met with a host of landowners at many of these sites and developed acquisition and management agreements to help protect imperiled plants on these properties.

### **United States Fish & Wildlife Service (USFWS) Partnership**

The Plant Conservation Program and USFWS continued a long-standing cooperative agreement related to the recovery of endangered and threatened species in North Carolina. Grant funds obtained under this cooperative agreement provide critical funds to North Carolina each year. This funding covers salary for PCP's research specialist, Lesley Starke and covered a second PCP position held by Yari Johnson until he accepted another position in August. A portion of the remaining funds supported a temporary employee, David Tart, for several months of the year and more recently have supported some of the activities of PCP's two late-year temporary employee hires: Kira Santuli and Philip Inman.

### **Partnership Projects**

The Plant Conservation Program is a member of several statewide or regional conservation partnerships and staff participates in these partnerships as time allows. The PCP has also continued to work closely in partnership with conservation organizations and land trusts across the state. PCP has expanded existing partnerships with the NC Museum of Natural Science, U.S. Army Corps of Engineers and NCDA&CS Research Stations.

Numerous coordination meetings were held with NC Forest Service personnel at locations across the state regarding prescribed fire planning including sites in Durham, Granville, Randolph, Transylvania, Henderson and Sampson counties.

Program staff regularly reaches out to the public with special presentations and by filling information requests. This year presentations included the following audiences: NCDA&CS field specialists, International Grassland Scientists, Village Nature Series (Cashiers, NC), Cullowhee Native Plant Conference, NC Botanical Gardens, Roseboro-Salemburg Community Members, Biltmore Garden Club, Highlands Native Plant Symposium, Uwharrie Garden Club and Friends of Plant Conservation.

Additionally, PCP supported the USFWS's North American Wetlands Conservation Act application for mountain bog land acquisition by providing a letter of support/match covering staff time of management on the Tater Hill Preserve in Watauga County.

Staff developed a new partnership to complete a section of the Mountains to Sea Trail (MST) in Durham resulting in trail completion across the Eno Diabase Preserve, a "missing link" location for the statewide trail.

PCP continued working with the Eno River Association on ecological restoration projects in Durham County. Accomplishments include debris removal, prescribed burn planning and implementation, and monitoring.

PCP has worked to create a Memorandum of Understanding with the Wildlife Resources Commission (WRC) in order to cooperate with this agency more fully on enforcement activities throughout the state. The MOU will be finalized in 2014.

New management partnerships with the NC Department of Transportation and the NC Forest Service Bridge Crew resulted in significant management benefits to Durham and Transylvania County preserves.

### **Regulatory Programs**

The Program is responsible for the protection and conservation of 419 plant species across North Carolina, of which 27 are also federally protected. Program staff meets quarterly with an interagency panel to review permit requests for projects affecting these protected plant species. Program staff continues to review requests for permits from individuals or institutions requesting to move or collect protected plants, including all state and federally listed plant species. This permit requirement applies to transplant and rescue projects, nurseries which propagate and sell protected species, public educational exhibits, as well as many scientific research projects. The review process incorporates input from the

US Fish and Wildlife Service and the NC Natural Heritage Program. Over 20 permits were issued and several additional requests were evaluated.

PCP worked with the Plant Protection Section in revising procedures for the Certificate of Origin for Protected Plants by producing an updated form that nursery inspection specialists will use for nurseries selling listed plants. PCP staff also assisted in several nursery inspections involving imperiled plants. PCP fielded various questions from the general public on the correct procedures for nurseries to take when selling protected plant species.

PCP compiled public comments regarding Venus flytrap (VFT) poaching precipitated by a theft in Wilmington's Alderman Park. The Plant Conservation Board listened to testimony from WRC officer Brandon Dean and authorized PCP to examine VFT status and pursue enforcement action on poachers. PCP has begun an investigation of poachers, seeking assistance from WRC and other law enforcement entities, and organized a focal group of plant and conservation experts to examine VFT legal status (currently special concern-vulnerable). The focal group recommended that VFT status be elevated to threatened based on new information on the threats facing this species and its precipitous decline in recent years. The Plant Conservation Scientific Committee and the Plant Conservation Board will consider this matter in 2014.

### **American Ginseng**

American Ginseng harvest and exports from North Carolina continued under regulations adopted by the NC Plant Conservation Board. Without monitoring by the Program, harvest and export from North Carolina will not be allowed by federal authorities who have listed this plant under the Convention on International Trade in Endangered Species (CITES).

For the 2012-2013 season, NCDA&CS inspectors certified 15,005.3 pounds of "Wild" harvested ginseng, 13.6 lbs of "Wild Simulated" and 17.0 lbs of "Cultivated" ginseng. In addition, 8.2 pounds of "Woods Grown" was harvested but not certified. A total of 38 license permits were issued during this ginseng season and excludes a license requirement for non-resident individuals who purchase from registered NC Ginseng Dealers. From these dealers, there was a total of over 10,000 harvester/digger entries, 5,500 Harvest Record forms, 1,300 Purchase Record sheets received and 250 Export Certification entries.



**Figure 35** Ginseng Root



## **Plant Pathology Program**

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### **Boxwood Blight – A Disease New To The U.S.**

Boxwood blight was first detected in North Carolina in October of 2011. Several new occurrences of this disease were observed in North Carolina nurseries during 2013. At nursery locations where boxwood blight is found, suspect plants are stop-saled. No actions are required at infected landscape locations.

In February 2012, NCDA&CS developed an optional “Boxwood Blight Statement Program.” Under the program, a North Carolina nursery receives a statement to accompany shipments into other states indicating that plants grown at the nursery are “apparently-free” of boxwood blight. The participating nurseries sign a compliance agreement stating that certain best management practices are followed. In addition, growers agree to self-monitor boxwoods for disease symptoms, and participating nurseries may be subject to extra inspections conducted by NCDA&CS field specialists. To facilitate this program, the NCSU Plant Disease and Insect Clinic assays samples collected during this process at no charge. As of December 2013, there are sixty one participants in the program. During 2013, nine of the compliance program participants observed boxwood blight in their fields. Statements were re-issued to two of these nurseries, which, after plant destruction, remained apparently free of blight. The other nurseries with positive occurrences either did not wish to remain in the compliance program, or were not re-issued a statement because blight remains in their fields. Inspections and audits are on-going at all locations.

In October 2013, NCDA&CS prepared and sent a letter to licensed nurseries concerning the risks posed by certain activities related to the use of boxwood as cut greenery. Boxwood greenery is a common component of holiday wreaths and garlands. The process of individuals going from field to field to cut this greenery is a possible pathway for the spread of boxwood blight. The letter urges growers to require sanitary precautions of all greenery cutters which are allowed onto their nursery grounds. North Carolina State University developed a fact sheet and list of sanitizers that were included with this mail-out. NC Cooperative Extension Service (NCCES) personnel continued with additional educational activities.

### **Export Certification**

Most agricultural commodities exported to foreign countries and to some U.S. states must be certified to meet certain plant-pest requirements. Countries and states differ as to what is perceived as a plant-pest risk. The Plant Pathologist received and handled requests from field specialists and USDA-APHIS-PPQ personnel for assistance with interpretation of plant disease and nematode certification requirements, development of specific certification procedures and protocols, and determination of disease organism distribution. Examples of specific issues include: Canadian tobacco re-exported to China, daylilies to the United Kingdom, grape cuttings to Chile, nursery stock to China, soybean seed to Uruguay, soybean seed to Argentina, and oak plants to Washington state (not ultimately feasible).

### **Tobacco Blue Mold Oospore Survey (for certification of tobacco to China)**

If blue mold of tobacco occurs in a state's tobacco crop in a given year, that state must complete field surveys to detect the spores of the blue mold fungus in order to export tobacco to China. Survey procedures developed by USDA-APHIS-PPQ must be followed. The Plant Pathologist has been the coordinator for this program every year since it began in 2001. She updates the NC survey procedures yearly and sends them to the NCSU Tobacco Pathology Specialist for distribution to NCCES personnel in the event that blue mold is detected. NCCES personnel conduct the survey by collecting samples from affected counties and submitting them to an approved lab (i.e., the NCSU Plant Disease and Insect Clinic). Industry groups pay for sample assays. Blue mold was not detected in NC during the 2012 or 2013 growing seasons. Therefore, surveys were not conducted even though preparations were made.

### **Nematode Certification**

Prior to 2013, plants and certain plant products were required to be certified as free of soybean cyst nematode (SCN) before being exported to Canada. As of November 25, 2013, sampling for SCN is no longer required for export of plants/plant products to Canada. California has similar import requirements concerning reniform and burrowing nematodes. To assist nurseries that request certification, Field Specialists collect soil samples and submit them to the NCDA&CS Nematode Assay Section lab according to procedures developed by the Plant Pathologist, who also provides oversight for this program. A sampling table based on numbers of plants or area sampled was developed by the Plant Pathologist. Using this table enables growers to pre-determine costs prior to sample collection and submission. [Note: Reniform and burrowing nematodes have not been found in any nursery in North Carolina. Reniform nematode was previously found in eight NC counties under agronomic field conditions, but burrowing nematode has never been found at any location.]

The Nematology Assay Section (NAS) Chief cooperates with the Plant Pathologist to test routine samples for soybean cyst nematode (SCN) in order to validate new-county detections. SCN was not detected in any new county in NC during this reporting period.

### **Import: Movement Of Plant Pathogens For Research And Other Purposes**

The Federal PPQ Form 526 ("Application and Permit to Move Live Plant Pests or Noxious Weeds") permits the movement of plant pathogens and other pests into North Carolina from other states or countries for research, diagnostic identifications, or commercial uses. USDA-APHIS-PPQ receives the application initially, evaluates it, adds conditions, and forwards the draft permit to the Plant Pathologist via the e-Permit system for evaluation, comments, and approval. Because all plant pathogenic organisms are subject to this requirement, the pest-risk of each organism is evaluated individually to ensure that adequate safeguards are listed in the conditions of the permits. As of April 30, 2013, the outgoing Plant Pathologist evaluated sixty-two permit applications. Several applications required further clarification or documentation from PPQ before State approval could be given. From September through December, the newly hired Plant Pathologist evaluated 13 permit applications. During 2013, 11 permit applications were for non-specified species or unknown organisms. Organisms requested by species name included 234 fungi, 46 bacteria, 9 viruses, and 34 nematodes.

### **Nursery: Submission And Diagnosis Of Problem-Plant Samples**

The Plant Industry Division does not maintain a lab for general diagnostic purposes. Plant Protection Specialists collect problem plant samples from nurseries during nursery inspections and submit them to the NCSU Plant Disease and Insect Clinic for diagnosis and control recommendations. The Plant Pathologist serves as the liaison between the specialists and the Clinic, assisting with interpretation of diagnoses and recommendations when necessary.

### **Sudden Oak Death**

#### **Nursery Survey**

Sudden Oak Death disease caused by the plant pathogen *Phytophthora ramorum* (*Pr*) is killing thousands of oak trees in California and Oregon. To prevent artificial movement out of the known infested areas, shipments of nursery host plants are regulated by federal (USDA-APHIS-PPQ) and state quarantines. Field personnel have been involved with conducting nursery surveys and regulatory inspections for this disease yearly since 2004. During the 2013 inspection season, surveys were part of the general nursery inspection program rather than the Cooperative Agricultural Pest Survey (CAPS) program. *Pr* was not found at any new locations throughout 2013.

#### **Regulatory Issue: Recurring-positive Nursery Dealer**

Ornamental plants at a nursery dealer in Mecklenburg County have tested positive for the plant pathogen *Phytophthora ramorum* (*Pr*) in all but one year since its first detection there in 2008. Although there were no positive plant or soil detections in 2011, a positive camellia was confirmed in April of 2012. As a result of the April 2012 detection, follow-up surveys were conducted in April 2013 and September 2013. All plants sampled in 2013 tested negative for *Pr*. Increased plant surveillance and monitoring will continue over at least the next year at this location. Despite the absence of symptomatic plants, the pathogen remains detectable in water both inside and outside the location. USDA-APHIS-PPQ does not take action against water and soil detections unless an infected plant is confirmed.

In the past, an *ad hoc* committee consisting of the Plant Pathologist, USDA-APHIS-PPQ, and NCSU personnel met to identify possible mitigation procedures directed at treating and protecting the water at this location. A summary of all activities conducted at this location since 2008 was prepared by the Plant Pathologist and shared with the committee. No feasible mitigation procedures have been identified to date.

#### **Regulatory Issue: Trace-forward notification**

NCDA&CS Plant Industry received one trace forward request from USDA-APHIS-PPQ in June, 2013. The trace forward request was related to *Phytophthora ramorum* host plants shipped into North Carolina from the State of Oregon. All follow results were negative for the disease.

### **Tobacco Plant Inspections**

The NC Tobacco Plant Certification Regulation requires anyone who moves tobacco plants into NC from another state to do so under an import permit system. There were no import permit applications received during this reporting period. Another aspect of the regulation requires that plants grown in NC

and sold for planting in a location more than seventy-five (75) miles away from the place of production must be inspected and certified. A major reason for this requirement is to prevent the artificial movement of blue-mold or virus-infected plants from one growing region into another, which could initiate a premature disease epidemic. There were no certified tobacco plant nurseries during this reporting period.

### **Vegetable Plant Inspections**

The Vegetable Plant Certification regulation requires weekly inspections and certification of vegetable plants grown in NC for sale to commercial growers. There were no vegetable plant nurseries certified under this regulation during this reporting period. However, special inspections were conducted at one large production greenhouse nursery to certify plants to meet the vegetable import requirements of another state. The North Carolina Crop Improvement Association (NCCIA) certifies a large number of sweet potato cuttings and “seed” under its certification program. Because NCCIA certification requirements meet or exceed the standards of the vegetable plant regulation, NCDA&CS accepts inspections and certification tags of NCCIA in lieu of its own.

No problems were found during routine spot inspections of imported vegetable plants offered for sale at nursery dealers during this reporting period.

In the previous reporting period, the field staff was involved with investigations to determine the source of an early detection of cucurbit downy mildew. Involvement with the issue continued through the current reporting period to ensure that there was not an on-going overwintering problem with greenhouse production of cucumbers. At the location in question, it was determined that cucumber greenhouse production was not a source for early introduction of the disease into field production areas.

The Plant Pest Administrator was notified by his counterpart in South Carolina of the detection of brassica downy mildew on plants originating in a plant production facility in South Carolina. The parent company owns numerous, similar production facilities all over the U.S., including three in North Carolina. The Plant Pathologist conducted an assessment of distribution and sales patterns and other information, concluding that there was no reason to believe that North Carolina nursery dealers had received infected plants. This appeared to be a localized occurrence in South Carolina.

### **Miscellaneous Activities:**

The Plant Pathologist participated in monthly, national conference calls pertaining to the Sudden Oak Death program and provided summaries to the Plant Pest Administrator. Monthly conference call participants routinely discussed issues such as: changes to national regulations, current trace-forward/trace-back investigations, updates from regulated states, on-going research, and workshop/training announcements. In addition, the Plant Pathologist maintained a laboratory to assay survey samples.

During this reporting period, the Plant Pathologist was involved with other plant disease issues. Examples include:

- answered questions from the public as they relate to the White Pine Blister Rust Quarantine, Sudden Oak Death program, and other diseases, as well as general plant problems;

- served as the contact between NCDA&CS and state and federal labs involved with testing NC plant samples for *Phytophthora ramorum*, boxwood blight, and other diseases and nematodes;
- moved some of the content originally housed on the NCDA&CS Intranet site to a Microsoft SharePoint Plant Protection group site; the Plant Pathologist updated documents housed here and tested the site for launch in early 2014;
- participated in conference calls with field specialists and other staff to clarify programs and answer questions;
- attended Thousand Cankers of Black Walnut meeting at the University of Tennessee-Knoxville; presented walnut-twig beetle trapping data on behalf of the State Entomologist;
- reviewed commodity import pest risk assessments prepared by USDA-APHIS-PPQ and considered the impacts of resulting trade changes for NC agriculture and natural resources;
- reviewed information concerning pests which are being considered for federal deregulation and considered possible consequences for NC agriculture and natural resources;
- continually reviewed scientific literature pertaining to new plant disease occurrences and research; developed an archive of important sources and articles for future reference;
- developed a database of *Phytophthora* species of potential concern with information such as: plant part(s) affected, symptoms, sampling methods, in order to stay abreast of future threats and ensure we sample and test for as many *Phytophthora* spp. as possible when conducting nursery routine surveys.

## **Regulatory Weed Program**

The North Carolina Regulatory Weed Program protects North Carolina agriculture, public health, and native plant ecosystems from the harmful impacts of noxious weeds. The regulation of noxious weeds is authorized by the North Carolina Plant Pest Law and the Aquatic Weed Control Act of 1991. Program activities include inspections, issuance of Phytosanitary Certificates, issuance of Scientific Permits for movement of regulated articles and the survey, control and eradication of listed noxious weeds. The Witchweed Eradication Project, funded by USDA-APHIS-PPQ, is also a vital part of the Regulatory Weed Program. In addition, the program manager recommends justified changes to the NC Administrative Code that are relevant to noxious weed listings and quarantine boundaries.

### **Program Accomplishment Highlights**

#### **Regulatory**

- 139 phytosanitary certificates were issued to support the witchweed quarantine program in 2012 and 98 were issued in 2013.
- During 2013, three Scientific Permits were issued to support research at the quarantined area of the Cherry Research Farm and one Scientific Permit was issued to support research on regulated aquatic plants at a private aquatic research facility.
- Listing of giant reed (*Arundo donax*): In June, 2012 the Plant Industry Division received a petition signed by the Environmental Defense Fund, American Rivers, NC Coastal Land Trust, NC Conservation Network, The NC Wildlife Federation and The NC Chapter of the Nature Conservancy to list *Arundo donax* (giant reed) as a Noxious Weed. *Arundo donax* is currently present in more than 20 counties in NC and is not listed as a Federal Noxious Weed. It has not generated reports, or any indication otherwise, of any significant detrimental impacts to crops or other desirable plants, livestock, land, or other property, or injury to the public health in North Carolina. Consequently, it was determined that it does not meet the requirements for placement on the North Carolina Noxious Weed List. In February 2013, The North Carolina Board of Agriculture concurred with the recommendations of the Plant Industry Division and declined to list *Arundo donax* as a Noxious Weed.

#### **Public Relations and Outreach**

- The NCDA&CS Weed Specialist served as President of the NC Exotic Plant Pest Council (NC-EPPC) for a second year. The Weed Specialist is also a board member of the Aquatic Weed Control Council and is serving as editor of the NC Vegetation Management Association Newsletter.
- As part of the annual meeting of NC EPPC, the Weed Specialist reached approximately 80 people to provide an alert for invasive plants on the Early Detection and Rapid Response list.
- The Weed Specialist made a presentation at the joint meeting of the Natural Areas Association and the National Association of Exotic Pest Plant councils on the Regulatory Considerations for Biofuel Feedstock Management. Several hundred people from the Southeast U.S. participate in the conference each year.
- Six presentations on cogongrass and other targets for Early Detection and Rapid Response were made around the state as part of a NC Forest Service workshop program on non-native invasive plants. Over 700 small landowners, and government agency personnel were reached during these workshops.



- On numerous occasions, assistance was provided to help identify weeds and provide weed control recommendations in crop, turf, aquatic and non-crop sites.

### **Witchweed Eradication Program Objectives, Methods and Rationale**

Witchweed (*Striga asiatica*) is a Federal Noxious Weed and a Class A State Noxious Weed in NC. It is an obligate parasite which attacks corn, sorghum, millet, and other warm season crops in the grass family. Heavy infestations of witchweed can eliminate yield from these crops, resulting in devastating economic losses. The presence of this quarantined pest also imposes a regulatory burden on crop production and on the movement of farm commodities, equipment, and other regulated articles. The Witchweed Eradication Program includes an organized and effective set of survey, control and regulatory procedures developed through early USDA-APHIS research. Specific objectives of the program include: 1) characterization of the infestation through survey; 2) control of existing infestations; and, 3) containment by preventing the movement of potentially infested articles out of established quarantine boundaries.

1. Survey – Survey is necessary to detect and verify the extent of witchweed (Detection and Delimiting surveys), evaluate the effectiveness of eradication treatments on infested properties (Appraisal surveys), and verify eradication of witchweed on sites released from quarantine (Released surveys). Additional survey of terminated acreage is required in order to confirm the long-term effectiveness of the eradication program. Survey is done through the growing season after host plants have started to grow from about the middle of June through the end of October or until the first frost.
2. Control – The objective of control treatments is to prevent witchweed seed production and eliminate witchweed seed from the soil. Herbicide treatments, hand pulling and disking help to control witchweed host plants and witchweed plants before they can flower and produce seed. Methyl bromide fumigation of additional infested acreage will destroy reserves of witchweed seed in the soil and accelerate completion of the eradication program. Ethylene applications also help to deplete soil reserves of witchweed seed by encouraging germination and subsequent control by exposure to treatments or a non-host crop. Control treatments can be completed during the growing season and into the winter months provided soil moisture and temperature are favorable for soil fumigation.
3. Regulatory – Regulatory activities aid in preventing the artificial spread of witchweed from infested areas to non-infested sites. These regulatory functions facilitate the interstate and intrastate movement of agricultural commodities from witchweed regulated areas.

### **Data Compilation Description**

A point system was developed for the program that provides a quantitative measure for moving fields from infested to a released status and from a released status to a terminated status. All control treatments and surveys are tracked in an ACCESS database that automatically updates the point values for released fields and tracks assigned point values for infested fields. New or re-infested fields are added to the infested field list when witchweed is confirmed in new fields or in fields that have been previously released. The points assigned to infested fields are determined by the nature of the field and the control activities that were done on it during the season. Once a field accrues five points it is advanced to “Release” status which means it is surveyed for a minimum of 10 years on a predetermined schedule

that includes some skip years and either a spot survey or survey of the whole field (general survey). A spot survey qualifies the field for 0.5 points and a general survey qualifies the field for 1.0 points. Once a field acquires a total of 10 points, of which 5 are assigned during the 10-year release survey period, it is terminated from the program.

The following summary tables show the status of acreage in NC as of the end of survey and treatment for the current growing season which usually occurs by mid-November each year. Since point values for a field are adjusted only once at the end of the growing season, it is not possible to obtain an accurate end of season account of field status until survey and treatment have ended for the year.

Following is a description of steps used to compile year-end summaries from the ACCESS database:

- Based on input from each inspector, infested field point values are manually adjusted to reflect current field conditions and treatments that were done during the year. In most instances fields will be advanced in point value. Some fields may qualify for release based on reaching a point value of 5. Infested field point value at the end of the season is a judgment based on knowledge of witchweed biology, field treatments and current field conditions. The new field point values are assigned at the end of the growing season after the first frost when it is assumed no more treatments for the year will be implemented and no new witchweed will be found.
- New fields are added to the data base and are assigned a new farm and/or field number. Re-infested field point values are changed to bring them back to values less than 5 so that they will be tallied as infested fields.
- After end of growing season adjustments, the data base is queried and standard reports are generated to provide updated statistics for acreages infested, released, surveyed and treated.

## **Summary of Results**

Table 15 summarizes acreage status for fields currently managed in the witchweed eradication program in North Carolina. The number of acres classified as infested dropped significantly in 2013 with a net gain of 417.50 acres moved to the released category. In addition, over 1,000 acres were terminated from the program so that a total of 8,585 acres are still subject to point system rules that include mandatory scheduled surveys.

**Table 15** Witchweed Eradication Acreage Status for 2012 and 2013.

Year	2012	2013
Total Acres in Infested Category	1,673.40	1,255.90
Total Acres in Released Category	8,457.00	7,329.10
Total Acres Managed by Program	10,129.40	8,585.00
Total Acres Treated	3,659.59	3,371.07
Total Acres Surveyed	86,308.00	71,139.90
Acres transferred from Infested to Release Category	182.10	466.90
Acres New or Re-Infested	<u>- 168.40</u>	<u>- 49.40</u>
<b>Net Gain in Eradicated Acres</b>	<b>13.70</b>	<b>417.50</b>

Other pertinent program data is summarized in Table 16. Eleven witchweed bounty payments were requested in 2013. Phytosanitary certificates are mainly issued for movement of straw mulch used by the North Carolina Department of Transportation. One-hundred three certificates were issued during 2013 compared to 139 issued in 2012. Witchweed was detected on 73 fields in 2013. Twenty of the fields with witchweed sightings during the year were classified as spot infestations at all survey dates indicating a less serious infestation than those infestations where the infestation was classified as general on at least one survey date.






**Table 16** Other Witchweed Statistics for 2012 and 2013

Year	2012	2013
Acres Treated by Contract	40.70	0
Counties now Infested in NC	5	5
Witchweed Bounty Payments	4	11
Associated Witchweed Bounty Acreage	39.40	121.5
Witchweed Infested Fields with Witchweed Sightings	74	73
Total Number of Witchweed Observations	193	178
Number of Phytosanitary Certificates Issued	139	103

The point status of infested fields provides an indication of how long it could be for infested fields to be released. Acreage currently with 4.0 or 4.5 points would have a high probability of being released within the next 2 years. Table 17 shows infested field acreage by point value and County for 2012 and 2013.







With over 700 acres in the 4.0 to 4.9 point range it is hoped that 2014 will show movement of several hundred acres to the released category. The arrows in Table 17 indicate whether total infested acreage has moved down, up, or stayed the same in 2013 compared to 2012. The same arrows are used in other tables in this report.

**Table 17** Infested Acreage by Point Value and County for 2012 and 2013

County		0-0.9 Acres	1-1.9 Acres	2-2.9 Acres	3-3.9 Acres	4-4.9 Acres	Infested Acres	
Bladen	2012	80.30	249.60	69.30	82.80	44.80	526.80	
	2013	89.10	183.80	120.70	78.50	10.20	482.30	
Cumberland	2012	59.50	43.70	30.30	127.70	535.30	796.50	
	2013	71.20	10.90	35.10	42.80	344.50	504.50	
Pender	2012	8.50	0.00	0.00	4.00	4.60	17.10	
	2013	0	8.50	0	0	4.00	12.50	
Robeson	2012	0.00	0.00	0.00	185.30	111.30	296.60	
	2013	0	0	0	8.00	228.60	236.60	
Sampson	2012	12.30	0.00	0.00	4.30	18.80	35.40	
	2013	0	12.30	0	4.00	3.70	20.00	
<b>Total</b>	<b>2012</b>	<b>160.00</b>	<b>293.30</b>	<b>99.60</b>	<b>404.10</b>	<b>714.80</b>	<b>1,672.40</b>	
	<b>2013</b>	<b>160.30</b>	<b>215.50</b>	<b>155.80</b>	<b>133.30</b>	<b>591.00</b>	<b>1,255.90</b>	

In addition to acreage infested, another measure of the size of the witchweed program is the number of infested farms and fields that are currently being managed with scheduled surveys and treatment applications. Table 18 shows the number of infested farms and fields currently in the program by county for 2012 and 2013. There are currently 98 farms and 136 fields classified as infested (i.e. fields with fewer than 5.0 points) in the program. Including released fields for which surveys are still scheduled, there are a total of 814 fields still managed by the program.

**Table 18** Number of Infested Farms and Fields by County for 2012 and 2013

County		No. of Farms	No. of Fields	Infested Acres	
Bladen	2012	34	49	526.80	
	2013	32	49	482.30	
Cumberland	2012	46	65	796.50	
	2013	44	60	504.50	
Pender	2012	1	4	17.10	
	2013	1	3	12.50	
Robeson	2012	22	27	296.60	
	2013	16	20	236.60	
Sampson	2012	6	7	35.40	
	2013	5	5	20.00	
<b>Total</b>	<b>2012</b>	<b>109</b>	<b>152</b>	<b>1,673.40</b>	
	<b>2013</b>	<b>98</b>	<b>136</b>	<b>1,255.90</b>	

Treated acreage is counted for each treatment event and fields may get treated more than once during the season (Table 19). The type of crop planted into infested fields is an important indication of whether or not witchweed is likely to emerge and be detected during the growing season. Corn is a primary host crop and was present on 39% of the 3,371.07 infested category field acreage treated in 2013. Corn acreage combined with an application of ethylene is also expected to reduce the eradication time by 1 to 3 years. A large portion of the infested acreage is idle land and classified into other categories such as garden plots or specialty crops. Idle land can easily be treated with herbicides, ethylene and disking, but garden spots are harder to manage because of proximity to residences and fewer herbicide options.

**Table 19** Summary of Treated Acreage by Crop Type for 2012 and 2013

Crop Name		No. of Acres Treated
Corn	2012	1,168.43
	2013	1,308.10
Soybean	2012	549.45
	2013	911.71
Idle	2012	1,062.12
	2013	686.36
Other	2012	879.59
	2013	464.90
<b>Total Crop Acres Treated</b>	<b>2012</b>	<b>3,659.59</b>
	<b>2013</b>	<b>3,371.07</b>

Witchweed treatments are applied to prevent witchweed from flowering and producing new seed and to deplete reserves of seed that may still be present in the soil. Ethylene applications help to hasten depletion of seed reserves by artificially stimulating witchweed germination. In the absence of host plants, germinating witchweed is unable to complete its life cycle and produce new seed. Disking will help to remove non-crop hosts and therefore also deny opportunities for additional witchweed seed production. Fumigation is rarely used in the program now due to new buffer zone and other regulatory requirements and high expense. Soil heat treatment, however, is used where it makes sense on small spots. Hand pulling of emerged witchweed plants before seed sets will also eliminate additional seed production. Herbicides are used in the witchweed eradication program to directly kill emerged witchweed plants and to kill weedy hosts in false host crops such as soybean or emerged witchweed in host crops such as corn or sorghum. Herbicides are also used to kill weeds on fringes of fields to provide better conditions for witchweed detection. Roundup Powermax® is the most commonly used herbicide due to the high percentage of soybeans and corn that are planted to Roundup-ready crops.

**Table 20** Summary of Acres by Treatment Type for 2012 and 2013

Treatment Type		No. of Acres Treated	No. of Treatments
<b>Disking</b> Treatment Code 39	2012	1,042.75	140
	2013	907.15	126
<b>Ethylene (Tractor and Hand)</b> Treatment Code 43	2012	572.00	57
	2013	435.39	74
<b>Hand Pulled</b> Treatment Code 61	2012	204.12	186
	2013	60.33	170
<b>Herbicide to Host</b> Treatment Code 94	2012	1,236.62	71
	2013	1,484.80	97
<b>Herbicide to Witchweed</b> Treatment Code 95	2012	328.62	47
	2013	133.55	32
<b>Herbicide (Survey Aid)</b> Treatment Code 96	2012	272.90	15
	2013	349.75	46
<b>Soil Heat Treatment</b> Treatment Code 97	2012	0	0
	2013	0.10	1
<b>Methyl Bromide</b> Treatment Code 49	2012	7.10	1
	2013	0.00	0
<b>Total Acres Treated</b>	2012	3,659.59	517
	2013	3,371.07	546



The success of the witchweed eradication program is largely dependent on the quality and quantity of field inspections completed during the growing season. Over 71,000 acres were surveyed during 2013 (Table 21). The number of acres surveyed in 2013 was less than in 2012 because temporary survey aides worked during a shorter time period in 2013 than in 2012.

**Table 21** Summary of Surveyed Acreage for 2012 and 2013

Category		Total Acres	
Appraisal	2012	12,958.10	
	2013	12,456.90	
Release	2012	24,215.30	
	2013	16,068.10	
Delimiting	2012	32,587.10	
	2013	36,320.70	
Detection	2012	16,547.50	
	2013	6,294.20	
Regulatory	2012	0.00	
	2013	0.00	
Appraisal	2012	12,958.10	
	2013	12,456.90	
Release	2012	24,215.30	
	2013	16,068.10	
Delimiting	2012	32,587.10	
	2013	36,320.70	
Detection	2012	16,547.50	
	2013	6,294.20	
Regulatory	2012	0.00	
	2013	0.00	
<b>Total Acres Surveyed</b>	<b>2012</b>	<b>86,308.00</b>	
	<b>2013</b>	<b>71,139.90</b>	

Surveys will determine the effectiveness of treatments on active fields (Appraisal Survey) and provide assurances that fields remain witchweed-free between the time they are released until they are terminated from the program (Release Survey). Delimiting surveys are also completed on fields adjacent to infested or released properties to assure infestations remain contained. Detection surveys are also completed on fields which may be outside of the witchweed quarantine area to ensure witchweed has not spread unexpectedly outside of the designated quarantine area. At one time fields were frequently surveyed to accommodate movement of regulated articles outside of designated quarantine boundaries. In recent years, surveys for regulatory purposes have not been required.

## **Discussion**

The unusually wet spring and early summer delayed the planting of soybeans on some fields. As a consequence, previously released or terminated fields were re-infested as witchweed attached to developing stands of crabgrass that would normally have been absent in managed soybean fields. Nevertheless, witchweed finds are being aggressively managed. In many instances, fields with witchweed finds were visited and treated every 10 – 12 days instead of every 21 days, thereby eliminating much of the risk that witchweed would flower and produce more seed. In addition, ethylene was more frequently applied by hand to treat known witchweed spots in the hopes this will help to deplete seed in isolated spots in active fields. On one occasion, soil on a small spot was heat-treated with propane burners. Heat treatment of soil will be used as an option on isolated spots when witchweed has already flowered and conditions are favorable for safe burning.

New procedures for entry of data into the ACCESS database that tracks field status were successfully implemented during the 2013 field season. The new procedures have eliminated the need for scan sheets and have enabled closer monitoring of data for entry errors and for tracking progress in survey and treatment activities. The new system also enables each Witchweed Plant Pest Inspector to directly update farm contact information and other descriptive information for the field including GPS reference points. GPS reference points for fields currently provide the only electronic records for field locations.

## **Noxious Weed Survey and Eradication Program Details**

Surveys for all projects were done by visual reconnaissance. Survey objectives are: 1) identify new infestations of target noxious weed (i.e. detection surveys); and, 2) delimit the boundaries where the weeds were mapped in previous years (i.e. delimiting surveys). Detection survey location targets were selected based on probability that subject plant pest would be present. In some instances GPS coordinates were recorded to provide reference points for mapping and relocation, if needed.

Roadsides close to wet areas and home landscapes were targets for purple loosestrife detection surveys. Locations known to have been infested with small broomrape (*Orobancha minor*) in the past were checked in spring or early summer for reoccurrence of the weed. A known infestation in a hay field was monitored to delimit the size of *Orobancha minor* infestation and to prevent additional spread by hand pulling plants at time of survey. Also, past known locations for itchgrass (*Rottboellia cochinchinensis*) were surveyed in June through October to confirm results of 2010 treatments and delimit known past infestations. Cattle slaughter houses and holding farms in Sampson County are surveyed annually for infestations of tropical soda apple.

Since plant species must be identified during the growing season, all surveys are done during the period from full leaf (June) through the first hard freeze (usually mid November).

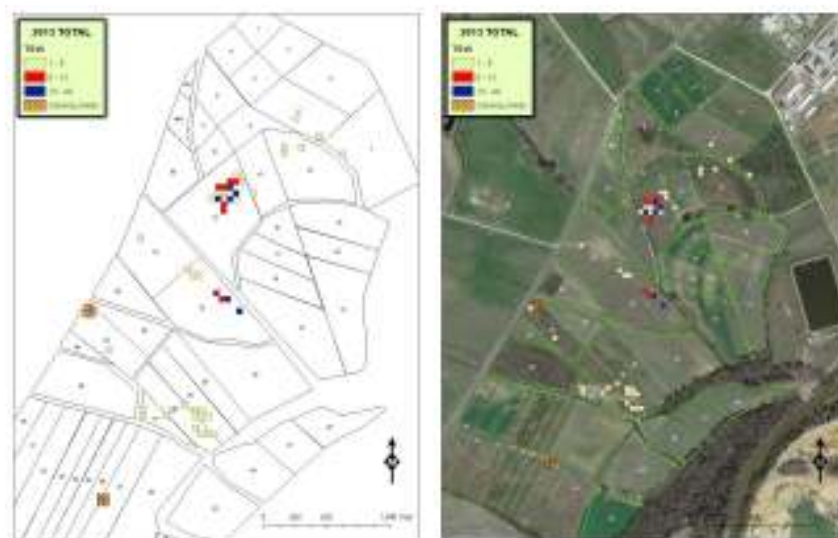
### **Tropical Spiderwort (TSW), *Commelina benghalensis***

The quarantine for *Commelina benghalensis* is still enforced at the Cherry Research Farm near Goldsboro. The quarantine at the Tidewater Research Station was terminated in April of 2011 and the last formal survey at that station was completed by October of 2011. At the Cherry Research Farm the infestation has been confined to the Farming Systems Research Unit (FSRU). The Center for Environmental Farming Systems has assigned a full time surveyor, Richard Banner, to monitor the FSRU for emerging TSW plants, map their location and destroy plants before flowering. The following report by Richard Banner, summarizes survey results at the Farming Systems Research Unit during 2013. The Plot numbers correspond with the FSRU assigned field numbers.

“In summary, this season was one of the wettest and coolest on record. The Tropical Spiderwort continues to decline at Cherry Farm. There was a relative 15 minutes of optimal weather for TSW early in the season which brought about a small growing peak. Since then it has either been too wet or too cool or both and the Tropical Spiderwort has struggled to produce. The timing of this year’s planting schedule allowed very good coverage, especially of the problem plots. Except for the demonstration plant and the two “crazy” ones in plot 47, nothing I found this year was even close to reproducing. Between the weather and the application of Reflex to the soybeans, I don’t think anything else lived long enough to reproduce. Everything found this season was in the usual locations with no outbreaks in new areas. The most excitement this year was a plant found in the middle of the road by 26. This was not a surprise; it was three feet from a known hot spot and has been found in the road there before. It is, however, the reason why we continue to wash the equipment even if all it did was travel on the farm roads. All in all, it was a very uneventful year for the Spiderwort.” Table 22 presents the survey results for 2013.

**Table 22** Tropical Spiderwort survey results

<i>PLOT</i>	<i>TSW</i>
6	13
7	1
12	182
13	1
14	11
22	2
23	128
26	24
27	12
28	3
47	10
<b><i>TOTAL</i></b>	<b><i>387</i></b>



**Figure 36 2013 TSW detection maps**

**Table 23** TSW survey results by year.

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013
TOTAL TSW	55061	19244	11782	4087	6374	5142	1975	852	387

A survey by NCDA&CS personnel involving several teams during one day in July, 2012 and one day in August, 2012 was completed on areas outside of the Farming Systems Research Unit. Two non-flowering TSW were discovered in Field D4 during the August survey. A 1.25 acre area around the spot was prepared for fumigation and treated with methyl bromide by a contractor on November 6, 2012.

All areas outside of the Farming Systems Research Unit were surveyed again with a crew of five surveyors on September 11, 2013. No tropical spiderwort plants were found during the 2013 survey.

In addition to the presence of TSW plants in the FSRU of the Cherry Research Farm, several plants were discovered in early September in two landscape beds at the residence of an NCDA&CS Plant Pest Specialist in Kinston, NC. The plants were officially identified as TSW by Dr. Alexander Krings at the NCSU herbarium. Both landscape beds were mulched in spring of 2013 with pine straw purchased at the Lowe's store in Kinston. It is believed that pine straw could be the pathway for the propagules that established the TSW in the landscape beds. The provider of pine straw at the Lowe's store in Kinston was contacted and a reply is still pending regarding their potential sources of pine straw from Georgia and/or Florida so that additional follow-up could be arranged with officials in either state.

### **Mile a Minute Vine, *Persicaria perfoliata***

Mile-a-minute vine has been documented in the following counties: Alleghany, Rockingham, Yancey, Guilford, Pasquotank, Perquimans and Gates counties. The quarantine area of mile-a-minute vine is still confined to only portions of Alleghany County. Additional quarantine areas have not been proposed.

The infestation in Rockingham County was first reported in 2011 and was located under the bridge for Highway Business Route 221 where it crosses the Mayo River. On August 28, 2013 the Mayo River

State Park superintendent reported another patch of mile-a-minute vine within the boundary of the state park and several hundred yards downriver from the Highway Business Route 221 bridge. The infestation infested a sand bar and the Mayo River edge and was confirmed as mile-a-minute vine on the same day. The release of mile-a-minute vine weevils in 2014, if available, was recommended as a management option at this site. It is suspected that mile-a-minute vine may exist on larger sites along the Mayo River tributaries that originate in Virginia.

Surveys on five separate occasions in April, May and June, 2013 resulted in confirmation of scattered plants moved by high water along Jacks creek in Yancey County. During survey, scattered plants were removed and destroyed.

The infestation in Guilford County was discovered on August 23, 2013 and reported to the Weed Specialist on Monday, August 26, 2013 via the new pest report phone number (1-800-206-Weed). Delimiting survey on August 28, 2013 showed that the infestation was limited to an area several hundred yards within a transmission line right-of-way on either side of Camp Burton Road. If available, mile-a-minute vine weevils will be released at the site in 2014.

The infestation in Pasquotank, Perquimans and Gates counties was first reported to the NC Forest Service by industrial timber management foresters and then referred to NCDA&CS by an email on September 5, 2013, for confirmation and follow-up. Roadside surveys in the area of the infestation confirmed that several miles of roadsides flanked by drainage ditches were infested on industrial forest lands in the general vicinity where Gates, Pasquotank and Perquimans counties meet. It is suspected that spread of mile-a-minute vine in this area was assisted by an abnormally wet summer that moved seed in drainage ditches. Mowing operations by the local hunt clubs is also another probable mechanism for seed movement. The industrial land managers applied herbicides along the roadside infestations in late fall, 2013 and are planning roadside herbicide treatments prior to seed development in late spring or early summer, 2014. Mowing operations will be either halted or modified to prevent contamination of mowing equipment and additional spread via mowing. In addition, the landowners were advised to monitor logging operations and place skid trails and log decks away from mile-a-minute vine patches.

A weevil that feeds exclusively on mile-a-minute vine was released again in 2013 in Alleghany County. More about this biocontrol effort is contained in another section of this report that describes projects of Plant Industry's Biocontrol Laboratory.

Appalachian State University continued to monitor the effectiveness of the weevil in containing the infestation and is also characterizing weevil reproduction, survival and spread in the Alleghany County area of the mile-a-minute vine infestation in addition to describing impact of the biocontrol effort on native plants.

Biocontrol with the release of the mile-a-minute vine weevil will be considered at all of the new mile-a-minute vine sites during 2014 with priority placed on the largest infestations in Pasquotank, Perquimans and Gates counties.

### **Bushkiller, *Cayratia japonica***

No new infestations of bushkiller were confirmed in North Carolina during this report period. Current infestations are being contained and in some instances, where eradication is the goal, only occasional plants are found. Infestations at Reynolda Gardens and the Old Salem Cemetery cover the most area. The goal at these sites is containment.



**Figure 37** Shredding of yard waste at the Winston/Salem yard waste facility.

The procedure used by the city of Winston-Salem to treat yard waste was reviewed to confirm that disposal of yard waste would not provide a pathway in rare instances where bushkiller may be included in yard waste collections. All yard waste is ground up and stored at the city collection site for distribution as mulch (Figure 37). The grinding operation and heating of piles during storage greatly reduces risk of escape for viable bushkiller fragments.

### **Broomrape, *Orobanche minor***

Surveys in Mitchell County were completed by the area Plant Pest Specialist, Tim Hartley, on 8 different occasions during April and May, 2013 with 10 plants discovered at only one site during the middle of May. All plants were pulled and incinerated.

*Orobanche minor* was discovered by Rebecca Norris and Kathy Kidd (NCDA&CS Plant Industry Biocontrol Laboratory) at the Western North Carolina Livestock Center near Canton, NC on May 23, 2012. Samples of the plant sent to David Bitzel, USDA Seed Examination Facility in Beltsville, MD were confirmed as *Orobanche minor*. The infestation covered an area approximately 10 to 15 feet wide and 400 ft long, located along the driveway to the offices of the livestock center. Stakeholders of the livestock center were informed of the infestation and a meeting was held on June 6, 2012 to discuss treatment options. The infested area was burned with propane torches on June 19, 2012 to kill surface seed.



The site was monitored during 2012 and treated as needed with a broadleaf herbicide to eliminate clover, which is a host plant of *Orobanche minor*.

Follow-up surveys were completed at the Western NC Livestock Center in spring 2013. About 300 plants were discovered near the entrance gate of the center. All plants were pulled and destroyed by incineration and a request was sent to the Western NC Livestock Center Operations Coordinator to discontinue mowing in areas about 30 feet long on both sides of the driveway inside the gate. Mowing was discontinued near the gate as requested.

### **Giant Hogweed, *Heracleum mantegazzianum***

Monitoring and treatment continued during 2012 at two giant hogweed sites near Blowing Rock. One of the sites inside the city limits of Blowing Rock is located in a homeowner's garden and involves only a few plants. Plants on this site were sprayed in the spring of 2012 and again in May, 2013.

The site on the outskirts of Blowing Rock was the source of seed for the Blowing Rock garden site and contained the most plants. More than 60 plants were sprayed with glyphosate by backpack in July, 2012. Follow-up survey and spot treatment to more than 100 plants was completed on three separate occasions in May and June, 2013.

Two additional giant hogweed sites on the outskirts of Blowing Rock were confirmed by NCDA&CS Plant Pest Specialist, Chad Taylor. One of the sites was on residential property in a garden area and the other site was on the Highway 221 right-of-way near a small stream and roadside waterfall. All sites on the outskirts of Blowing Rock are in the same vicinity. Plants at both sites were treated with a 1.5% solution of Shore-Klear® (glyphosate herbicide) on August 2, 2013.



**Figure 38** Giant hogweed near Blowing Rock, NC.

### **Cogongrass, *Imperata cylindrica***

Cogongrass is considered a serious invader due to its ability to establish on a variety of soils and sites and ability to change ecosystem function by creating conditions for more frequent and hotter fires. It is a Federal and State of NC Noxious Weed that continues to invade thousands of acres across the Southeastern U.S.

A naturalized colony of cogongrass was discovered for the first time in North Carolina by the Pender County Horticulture Extension Agent, Charlotte Glen. The infestation, located in Pender County, was sprayed in June, 2012. No new re-sprouts were detected at this site during the remainder of 2012 or in the spring of 2013. In addition, no additional sites were found during delimiting surveys in June, 2012 and May, 2013.



**Figure 39** Cogongrass ID training session in Stanly County, June 5, 2013.

In May, 2013 a second cogongrass infestation, less than 200 square feet in area, was discovered by a NC Forest Service employee on private forest land in Stanly County. The plants were confirmed as cogongrass during a subsequent visit to the site on June 5 after seedheads had emerged. An identification training workshop was held at the site for local U.S. Forest Service, NC Forest Service, NCDA&CS employees and a Stanly County Cooperative Extension Agent (Figure 39). Twenty-six people participated in the workshop. Thirteen seedheads collected at the site were inspected by the NCDA&CS, Plant Industry Seed Laboratory to determine if viable seed was present. No viable seed was found in the sample. A delimiting survey around the site was completed on June 20 and the infestation was sprayed with imazapyr herbicide on July 15, 2013. The sprayed area was then burned on September 19, 2013 to remove dead leaves and assist with detection of re-sprouts in early summer 2014.

### **Purple Loosestrife, *Lythrum salicaria***

Sixteen sites near Winston-Salem are surveyed annually for the presence of purple loosestrife. Surveys were completed in July, August and September of 2013. In 2012, a few scattered loosestrife plants were detected and treated at all but one of the sites. All sites had purple loosestrife on them during 2013 and more plants were encountered during 2013 than in 2012, probably due to the wetter than normal months of June and July. Plants that are detected during survey are treated with a 1.5% solution of Element® 3A (triclopyr). Also, the flowering portion of the plants were collected, bagged and incinerated in the hopes of preventing the addition of seed to the site.

Purple loosestrife was also discovered in 2011 on a site occupying several acres at the Henderson County airport and along the City of Hendersonville sewer line right-of-way (Figure 40). The site was discovered by a stewardship biologist with the NC Wildlife Resources Commission. Herbicide treatments at the site continued during 2012 in cooperation with the Wildlife Resources Commission and the City of Hendersonville.

On August 10, 2012 the city of Hendersonville reported they had also scheduled treatment of a stand of purple loosestrife near the city water treatment plant using their contractor. Follow-up treatment by NCDA&CS was also done on August 28, 2012 along the airport ditches and the infested ditches along New Hope Road between the airport runway and a soybean field. About 30 clumps of purple loosestrife were sprayed at that time.



**Figure 40** Location of Purple Loosestrife in Henderson County.

The yellow pin marks the NE endpoint of the infestation that runs along New Hope Road at the NW end of the airport.

Follow-up surveys were done along the airport ditches and the New Hope Road ditch in late April and early May, 2013. Purple loosestrife plants were just starting to emerge and numerous plants were sprayed with glyphosate during a subsequent visit on May 28, 2013. Plants were also sprayed on visits to the site on July 29, 2013 and August 4, 2013. Random plants were treated along New Hope Road, along the sewer line, along the edges of two soybean fields and along the ditches of the airport runways.

Bass Lake near Blowing Rock and about a 2 acre area in Onslow County are also surveyed annually for the presence of purple loosestrife. In July, 2012 about 8 plants were treated by backpack on the edge of Bass Lake with a 1.5% solution of Rodeo® herbicide and surfactant. No plants were found at the Bass Lake site in 2013. About 20 purple loosestrife plants were treated with a 1.5% solution of Element® 3A and 0.5% solution of surfactant at the Onslow County site on July 18, 2013.



### **Tropical Soda Apple, *Solanum viarum***

Cattle moved from other states with known infestations of tropical soda apple and held in pastures prior to processing can be a potential source for tropical soda apple infestations. Past infestations at Martin's Meats and Abattoir and Faircloth Farms in Sampson County prompted the need for annual visual surveys at these high risk sites. If encountered, the tropical soda apple plants are pulled and destroyed by incineration. Annual surveys have been successful in almost eliminating the occurrence of tropical soda apple at these locations. However, during 2013, disking on one field at Faircloth Farms had apparently stimulated the germination of residual seed that resulted in the growth of several hundred plants during the summer of 2013, most of which were bearing fruit.

During 2013, survey was done at Martin's Meats on July 30 and October 1 and at Faircloth Farms on September 20, September 23, October 1 and October 17. The September 20, 2013 survey at Faircloth Farms was prompted by a report from the farm manager of tropical soda apple on a field which had been tilled and re-established with grass (Figure 41). Several hundred plants were hand pulled from the field and surrounding area. During a follow-up survey on October 17, only 11 additional plants were found.



**Figure 41** Tropical soda apple at Faircloth Farms in September, 2013.

### **Itchgrass, *Rottboellia cochinchinensis***

Three general areas in Robeson County continue to have small infestations of itchgrass. Weed management in the existing crops, especially those that are Roundup Ready, tends to reduce or eliminate annual itchgrass infestations but plants still infest field borders and occasionally roadsides. The goal of the current itchgrass program is to prevent the establishment of itchgrass on high risk pathways, such as roadsides where seed can move with Department of Transportation mowing equipment.

During 2013, a small patch of itchgrass was reported in a new location near the North Carolina border with South Carolina in Robeson County. The patch was treated with glyphosate in July.

### **Oriental bittersweet, *Celastrus orbiculatus***

Each year, Plant Pest Specialists, responsible for counties within the oriental bittersweet quarantine area, distribute colored invasive plant warning tags to retail outlets so that the retailers can provide them to purchasers of oriental bittersweet materials, such as holiday wreaths. The tags warn purchasers that oriental bittersweet is an invasive plant and that disposal in a natural setting or mulch piles could lead to establishment of this serious invasive plant. The tags also instruct purchasers to dispose of any oriental bittersweet materials in plastic bags destined for landfills.

In 2013, stop sale notices were issued to two vendors at the Raleigh Farmers Market and to two vendors at the Piedmont-Triad Farmers Market.

An oriental bittersweet sales prohibition alert was sent to the Regional Farmers Markets in early November, 2013. In addition, a letter along with a one-page flyer was sent to over 150 local markets across the state to ensure vendors were aware of the oriental bittersweet sales prohibition outside of the designated quarantine counties in the Western part of NC.

### **Chinese Water Spinach, *Ipomoea aquatica***

Compliance agreements permitting the culture of Chinese water spinach for human consumption were issued to one grower in Pasquotank County, one grower in Wake County and one grower in Randolph County.

### **Giant Salvinia, *Salvinia molesta***

Giant Salvinia (*Salvinia molesta*), a Federal Noxious Weed, was detected at an aquatic nursery's display at the North Carolina State Fair in 1998, and subsequent surveys by NCDA&CS, NCDENR, and NCSU personnel resulted in detections in 26 counties in North Carolina. All of these infestations have been eradicated. However, in September 2000, naturalized infestations of Giant Salvinia were detected in golf course ponds in New Hanover County and in a canal and wetland at the Riverbend Subdivision near Burgaw in Pender County. Acting under the authority of the Aquatic Weed Control Act of 1991, NCDENR Water Resources personnel began eradication treatments at these sites in November, 2000. Survey of the Northeast Cape Fear River and adjacent wetlands at the Pender County site in 2005 and 2007 yielded no new finds of Giant Salvinia. Survey and monitoring of the River Bend site in Pender County has continued to the present.

A biological control program for Giant Salvinia at the Pender County site was initiated in 2004 with two releases of the Salvinia Weevil (*Cyrtobagous salviniae*) in June and September. Observations throughout 2005 confirmed the successful overwintering and survival of the Salvinia Weevil in Pender County, but this biocontrol effort was not deemed appropriate as we approached eradication of this plant and the biocontrol program was discontinued in 2008.

Current status as of December, 2013: A contract for survey and treatment of the River Bend Subdivision swamp was awarded for the final time during the 2011 growing season. **During 2012 and 2013, NO giant salvinia plants were discovered.**

### **Hydrilla, *Hydrilla verticillata***

#### **Lake Waccamaw**

In October of 2012 hydrilla was discovered in Lake Waccamaw, a unique and valued state water resource. Concern about the infestation prompted the formation of the Lake Waccamaw Technical Advisory Committee (LWTAC) to develop an eradication plan and identify funding sources for an estimated cost of about \$500,000/year for several years. The NCDA&CS, Weed Specialist participated as a member of the LWTAC.

Without treatment, the current infestation of 600 acres can quickly spread to the remaining part of this 9,000 acre lake. Impacts would include displacement of native flora and fauna, impeded recreational use, an increase in mosquito breeding habitat, depreciation of the lake's aesthetic value and a potential decrease in the value of private lake properties. The LWTAC completed an Environmental Assessment and drafted a management plan for the control and growth of hydrilla. Those documents were approved by the appropriate North Carolina State agencies. Funding was provided for the first treatment on June 4, 2013 by the NC DENR Water Resources Division, with cost share funding from the City of Lake Waccamaw and Columbus County. Additional cost share funding for future treatments will be requested from appropriations in the new budget year.

#### **Eno River**

The discovery of hydrilla in the Eno River also prompted concern (Figure 42). A committee was formed under the leadership of Eno River State Park personnel to discuss ramifications of the infestation and discuss potential actions. The NCDA&CS Weed Specialist also participates on this committee. Treatment of this infestation would be more complicated because of the broad and varied stakeholder impacts and the need for an effective treatment system in flowing waters. During 2013 a comprehensive survey of hydrilla in the Eno River system was completed under the direction of the North Carolina Wildlife Resources Commission so that the extent of the problem could be defined. Funding sources have not yet been identified for control of hydrilla in the Eno River.



**Figure 42** Hydrilla infestation at Eno River State Park.

### **Aquatic Dealer Inspections**

Aquatic dealer inspections are completed each year by the Division's Plant Protection Specialists. In 2013, approximately 100 active aquatic plant dealers were inspected in 43 counties. Fourteen of the 101 dealers that were inspected were noted as no longer selling aquatic plants. No significant issues were discovered during inspections. As part of the inspection process, the plant protection specialists also advised dealers to inform customers about the importance of not disposing of non-regulated, but potentially invasive aquatic plants, such as water hyacinth, parrot feather and water lettuce into outdoor water bodies if they sold these species. Five such advisories were issued in 2013.



## **ACCOMPLISHMENTS: SEED AND FERTILIZER SECTION**

The mission of the Seed and Fertilizer Section is to improve the profitability and sustainability of agriculture in the state by ensuring the seed, fertilizer, lime, and other soil additives offered for sale in North Carolina meet prescribed standards and are properly labeled.

The mission of this section is accomplished by:

- Ensuring that all locations that offer seed, commercial fertilizers, agricultural liming materials, landplaster, and soil additives for sale in the state are registered.
- Implementing a sound regulatory compliance program by conducting inspections and sampling of seed and fertilizer offered for sale in the state.
- Implementing seed purity, germination, and other specialized laboratory tests in support of the seed regulatory and service programs.
- Implementing a joint federal/state administered biotechnology permitting and inspection program.
- Conducting the fertilizer bioassay and endophyte testing programs.
- Coordinating activities of the N.C. Seed Board such that complaints regarding the failure of agricultural or vegetable seed to produce or perform as labeled or warranted are heard and responses are provided.

The Seed and Fertilizer Section includes 25 staff members with responsibilities and accountability for administrative, field services and North Carolina Seed Lab functions of the unit. The total budget for the Seed and Fertilizer Program for 2012-13 was \$1,549,497 including a state appropriation of \$688,484 and receipts of \$881,013. Revenues included receipts from licenses, registration fees, and tonnage fees.

### **Seed and Fertilizer Field Programs**

During the fiscal year 2012-13 the Seed and Fertilizer Section remained very active providing services to producers and individuals within NC and some service to non-residents of the state. Administrative staff was responsible for issuing 4,842 licenses for business that sold wholesale and retail seed. During the 2012-13 fiscal year 631 fertilizer licenses were issued to companies manufacturing or distributing fertilizer products. These products were sold through chain and private retail outlets and through 225 farm supply outlets.

Seed and Fertilizer Field Staff are responsible for conducting inspections and sampling seed and fertilizer offered for sale in the state. The staff also implements a regulatory program to ensure full compliance with applicable laws and regulations. An overview of program accomplishments is provided in Table 24.

Seed and Fertilizer Field Staff also provided support to the N.C. Department of Transportation by collecting 303 samples from 235 seed lots to be utilized on highway projects. The lab tests performed on these seed lots detected several violations and as such remain a critical part of the program.

Commodity prices for most major crops remained at high levels in 2013 and this was reflected in additional tonnage being applied. Along with traditional fertilizers, producers also took advantage of animal waste and poultry litter to provide nutrients to their crops.

**Table 24 2012-13 Seed and Fertilizer Program Inspection and Regulatory Activities**

<b>Number of Seed and Fertilizer Dealer Visits:</b>	<b>5,856</b>
<b>Seed and Fertilizer Samples collected</b>	
Official Seed Samples	2614 (46,194 lots)
Official Fertilizer/Lime Samples	1919 (29,595 lots)
<b>Regulatory Compliance Program</b>	
Seed Stop Sales Issued	43
Seed Stop Sales Issued and Resolved on Site	998
Seed Stop Sales (N.C. Seed Lab)	256
Fertilizer Stop Sales Issued	10
Fertilizer Stop Sales Issued and Resolved on Site:	11

Table 25 and Table 26 provide additional information on fertilizer and lime samples taken by field staff and subsequently analyzed to ensure compliance with applicable statutes and regulations.

**Table 25** Data of fertilizer samples analyzed for the current and previous fiscal years

FERTILIZER SAMPLING AND TONNAGE						
<u>Year</u>	<u>#Samples</u>	<u>#Compliant</u>	<u>%Compliant</u>	<u>Tonnage Reported</u>	<u>Tonnage Sampled</u>	<u>%Sampled</u>
2012-13	1,228	868	70.68	1,378,111	21,920	1.59
2011-12	1,195	876	73.31	1,243.164	56,762	1.5
2010-11	1,437	1,019	70.90	1,295.362	33,170	2.56
2009-10	1,651	1,141	69.11	1,251.026	26,539	2.12
2008-09	1,484	1,069	72.52	1,073,286	35,598	3.32

**Table 26** Data of lime and landplaster samples analyzed for the current and previous fiscal years.

LIME SAMPLING AND TONNAGE						
<u>Year</u>	<u>#Samples</u>	<u>#Compliant</u>	<u>%Compliant</u>	<u>Tonnage Reported</u>	<u>Tonnage Sampled</u>	<u>%Sampled</u>
2012-13	692	615	88.87	825,596	33,941	4.11
2011-12	758	541	71.37	767,766	36,965	4.8
2010-11	895	724	80.90	793,925	43,680	5.50
2009-10	729	611	83.81	640,106	35,793	5.59
2008-09	871	720	82.66	687,605	43,295	6.3

During 2013 two legislative changes affected the seed and fertilizer industries.

(1) Registration fees for seed packages five pounds or less than five pounds increased from thirty dollars (\$30.00) to fifty-five dollars (\$55.00) effective July 1, 2013.

(2) Seed regulatory violation penalties increased from five hundred dollars (\$500.00) to ten thousand dollars (\$10,000) effective December 1, 2013.

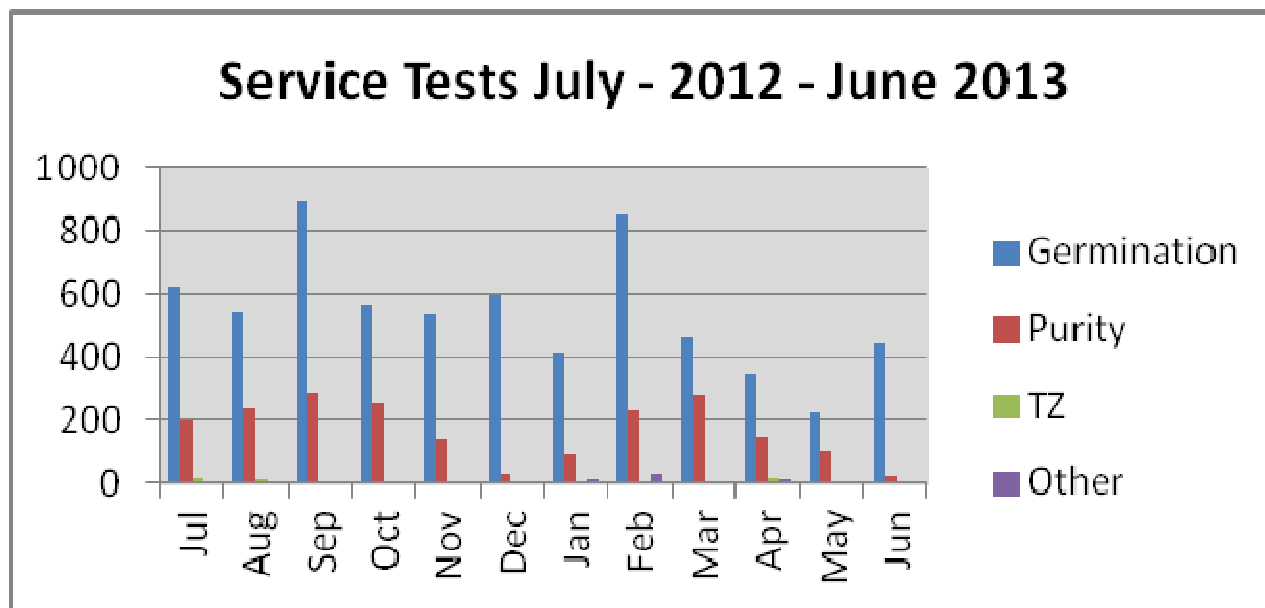
## **N.C. Seed Laboratory**

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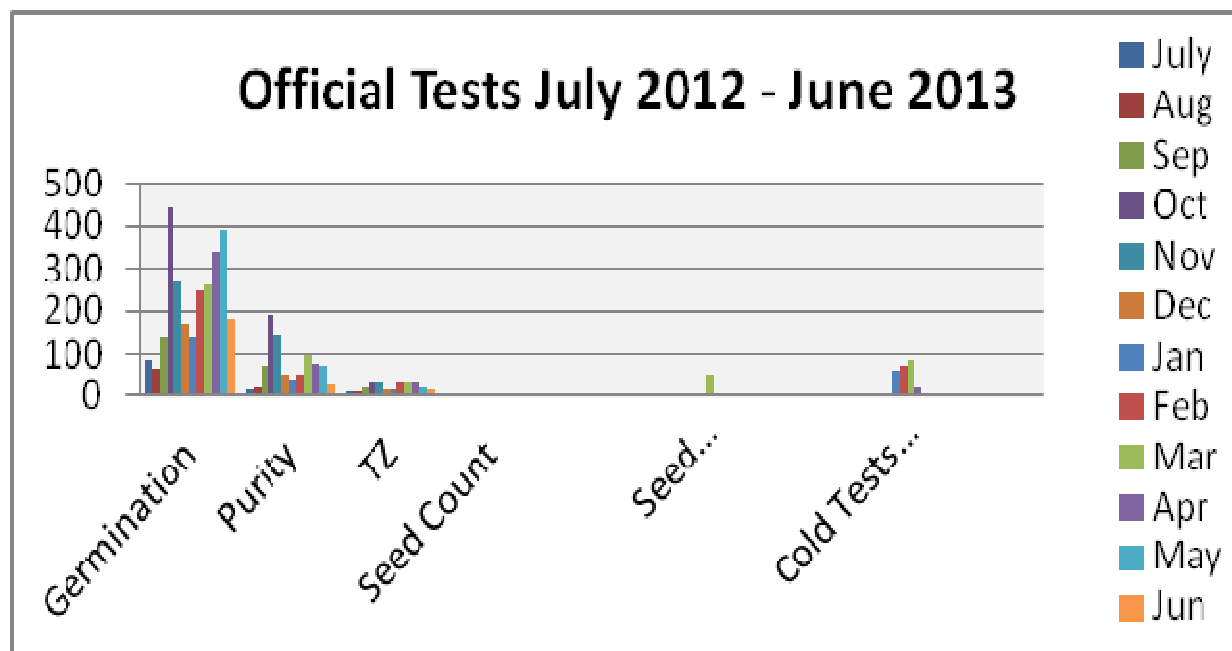
The North Carolina Seed Laboratory is responsible for providing laboratory support for both regulatory and service areas including the state's seed dealers, producers, university researchers and consumers. The work of this laboratory provides critical seed testing data needed to make management decisions regarding seed stock and for labeling purposes. For 2012-13, the North Carolina Seed Laboratory conducted 4,326 regulatory seed tests and 9,126 service seed tests. These tests accounted for required testing involving purity and germination. Multiple tests are generally conducted on each of the samples submitted with 13,452 individual tests carried out. Additional special tests include tetrazolium, accelerated aging, cool test of cotton, cold test of hybrid corn, phenol, Round-up Ready™ tolerance, sand, and moisture testing. There were 665 special tests conducted during the fiscal year.

The Seed and Fertilizer Section continued to implement the endophyte testing service. A number of grasses, including tall fescue and perennial ryegrass, contain a fungal endophyte which has a beneficial relationship with the grass host. The tall fescue endophyte, *Neotyphodium coenophialum* (previously *Acremonium coenophialum*), lives exclusively inside plants, and can only be detected through laboratory analysis. This endophyte has been proven to give the grass insect, disease and mammal resistance. Though very beneficial to tall fescue plants, this endophyte produces chemicals which are toxic to a variety of animals. In North Carolina, fescue toxicosis is especially a problem in horses and cattle. A total of 10 pasture samples were processed for producers.

The North Carolina Seed Laboratory and its staff remain active in the activities of the Association of Official Seed Analysts (AOSA) and the Association of American Seed Control Officials (AASCO). At the state level, program staff remains active in the North Carolina Seedsmen's Association (NCSA) and the North Carolina Crop Improvement Association (NCCIA). Due to peanut testing requirements initiated by the NCCIA, peanut purity testing was resumed for the 2012 crop year.



**Figure 43** Seed Laboratory Service Tests



**Figure 44** Seed Laboratory Official Tests

### **Joint Collaboration with USDA, Biotechnology Regulatory Services**

Seed and Fertilizer Section staff worked with USDA, Biotechnology and Regulatory Services (BRS) to jointly administer a federal/state biotechnology and permitting program. Primary responsibilities included reviewing permits and acknowledgements provided through USDA-BRS for laboratory, greenhouse, and field tests of genetically engineered crops. For this period, NCDA&CS staff reviewed a total of 327 notifications and permits. A joint project with USDA-BRS continued during this period involving NCDA&CS staff with inspections of *Notification and Permit Release Sites*, including pharmaceutical/industrial trials. As a prerequisite for participation in the project, all field staff were required to participate in training focusing on work flow, confidential business information, and steps in effectively completing a field inspection.

### **N.C. Seed Board**

The scope of the N.C. Seed Board is to review complaints from individuals who may have suffered damage from the failure of agricultural or vegetable seed to perform as labeled or warranted, or as a result of negligence. Such performance issues related to seed purity, seed germination, varietal purity, lot number of other lot identification, percent weeds, inert material, other crop seed and test date. For this period, complaints raised were resolved prior to N.C. Seed Board consideration.

### **N.C. Tobacco Variety Evaluation Program**

The Tobacco Variety Evaluation Program continued in joint cooperation with N.C. State University. Samples from 48 flue-cured tobacco seed lots were obtained for planting grow-outs in the variety testing program. All seed lots tested were found truthfully labeled as to variety and recommended for sale by the committee.